Chapter 2
Proposed Action and Description of the Alternatives

This chapter includes an overview of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) requirements for a project description. It also includes a description of the alternatives formulation process to select a reasonable range of alternatives and a description of the Proposed Action and alternatives to the Proposed Action.

2.1 NEPA Requirements

Federal law outlines the required components of the "alternatives" section of an Environmental Impact Statement (EIS) (40 CFR Part 1502.14), which include the following:

(a) Rigorous exploration and objective evaluation of all reasonable alternatives, and for alternatives which were eliminated from study, a brief discussion of the reasons for their having been eliminated.

(b) Substantial treatment of each alternative considered in detail, including the proposed action, so that reviewers may evaluate their comparative merits.

(c) Inclusion of reasonable alternatives that are not within the jurisdiction of the lead agency.

(d) Inclusion of the alternative of no action.

(e) Identification of the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identification of such alternative in the final statement unless another law prohibits the expression of such a preference.

(f) Inclusion of appropriate mitigation measures that are not already included in the proposed action or alternatives.

2.2 CEQA Requirements

The CEQA Guidelines[1] developed by the California Natural Resources Agency include prescriptive requirements for the components of the "project description" section of an Environmental Impact Report (EIR). The required components from Section 15124 of the CEQA Guidelines are listed below. Table 2-1 indicates the chapter and section in which each component is included in this EIS/EIR.

[1] Title 14, California Code of Regulations, §§ 15000–15387.

(a) The precise location and boundaries of the proposed project shall be shown on a detailed map, preferably topographic. The location of the project shall also appear on a regional map.

Table 2-1. Location of CEQA Guidelines Section 15124 Project Description Components

Component	Location
(a) Map of project location and Boundaries	Section 1.1
(b) Project objectives	Section 1.4.2
(c) General description of the project's characteristics	Section 2.4.3
(d) Statement of the intended uses of the EIR	Section 1.4.1
(d)(1)(B) A list of permits and other approvals required to implement the project	Chapters 6 and 7

(b) The document will include a statement of objectives sought by the proposed project. A clearly written statement of objectives will help the lead agency develop a reasonable range of alternatives to evaluate in the EIR and will aid the decision-makers in preparing findings or a statement of overriding considerations, if necessary. The statement of objectives should include the underlying purpose of the project.

(c) A general description of the project's technical, economic, and environmental characteristics, considering the principal engineering proposals, if any, and supporting public service facilities.

(d) A statement briefly describing the intended uses of the EIR.

(1) This statement shall include the following, to the extent that the information is known to the lead agency:

(A) A list of the agencies that are expected to use the EIR in their decision-making.

(B) A list of permits and other approvals required to implement the project.

(C) A list of related environmental review and consultation requirements required by federal, state, or local laws, regulations, or policies. To the fullest extent possible, the lead agency should integrate CEQA review with these related environmental review and consultation requirements.

(2) If a public agency must make more than one decision on a project, all its decisions subject to CEQA should be listed, preferably in the order in which they occur.

2.3 Alternatives Development

Both NEPA and CEQA require EIS/EIRs to identify a reasonable range of alternatives and provide guidance on the identification and screening of such alternatives. For this EIS/EIR, the Lead Agencies followed a structured, documented process to identify and screen alternatives for inclusion in the EIS/EIR. Figure 2-1 illustrates the process that the Lead Agencies conducted to identify and screen alternatives.

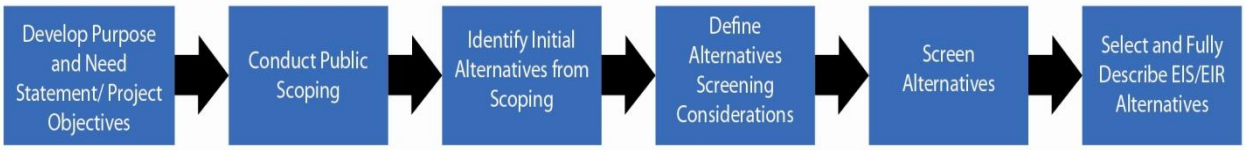


Figure 2-1. Alternatives Development and Screening Process

During public scoping, the public provided input regarding potential alternatives to the Proposed Action. The Lead Agencies reviewed the purpose and need/project objectives statement, public scoping comments, and previous studies in their initial effort to develop conceptual alternatives. This resulted in an initial list of action alternatives described in Appendix A, Alternatives Formulation Report. The initial list included more than 18 alternatives; however, some were determined to have limited functionality as full alternatives because they focused on techniques for improving natural resources conditions that are already a part of the Klamath Basin Restoration Agreement (KBRA) and were screened out. The Lead Agencies then developed and applied a set of screening considerations to determine which alternatives should move forward for further analysis. Some alternatives were evaluated based on preliminary analysis conducted during the EIS/EIR development, as discussed in Appendix A.

Alternatives may have moved forward for detailed analysis in the EIS/EIR if they do not fully meet the purpose and need/project objectives but may be able to reduce environmental effects or help create a reasonable range of alternatives.

Both NEPA and CEQA include provisions that alternatives meet (or meet most of) the purpose and need/project objectives, and be potentially feasible. Under CEQA, alternatives do not need to meet all of the project objectives; alternatives should be included if they can meet most of the objectives and avoid or substantially lessen significant environmental impacts of the project. The alternatives that moved forward for more detailed analysis in this EIS/EIR are those that best meet the NEPA purpose and need and CEQA objectives, minimize negative effects, are feasible, and represent a range of reasonable alternatives. Some alternatives do not fully meet the purpose and need/project objectives, but they have potential to minimize some types of environmental effects or help create a reasonable range of alternatives for consideration by decision-makers. Table 2-2 presents the screening results for the 18 initial alternatives. A full description of the alternatives and the rationale for screening the alternatives is presented in Appendix A, the Alternatives Formulation Report.

Table 2-2. Initial Alternatives

Alternative Number	Alternative Name	Description	Screening Result
Alternative 1	No Action/ No Project	Implement none of the action alternatives; Klamath Hydroelectric Project would continue current operations.	Alternative 1 moved forward to the EIS/EIR for further review because it is required under NEPA and CEQA.
Alternative 2	Full Facilities Removal of Four Dams (Proposed Action)	Remove four dams and related facilities.	Alternative 2 moved forward to the EIS/EIR for further review because it fully meets the purpose and need/project objectives.
Alternative 3	Partial Facilities Removal of Four Dams	Remove main areas of four dams to allow a free-flowing river and volitional fish passage; related facilities and/or abutments may remain.	Alternative 3 moved forward to the EIS/EIR for further review because it fully meets the purpose and need/project objectives.
Alternative 4	Fish Passage at Four Dams	Construct fish passage facilities to provide upstream and downstream passage at four dams.	Alternative 4 has been retained for further analysis because the No Action alternative, per the requirements of NEPA, may not presume the types of conditions that FERC might require should it re-issue a license under the Federal Power Act. Consequently, without this alternative, there would be no analysis in this document on fish passage. The lead agencies believe it is appropriate to include in the alternatives for further consideration our best assessment of probable fish passage. By bringing the fish passage alternative forward, the public will be better informed, which will in turn help foster better decision-making by the Secretary, all of which being consistent with the goals of NEPA.
Alternative 5	Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate	Remove Copco 1 and Iron Gate Dams, construct fish passage at J.C. Boyle and Copco 2 Dams.	While Alternative 5 does not fully meet the purpose and need/project objectives, it moved forward to the EIS/EIR for further review because it could lessen potential construction-related environmental and power generation effects of the Proposed Action. Additionally, it would lessen water quality effects of the two larger reservoirs. Consideration of this alternative would give the Secretary a reasonable range of alternatives to inform decision-making.
Alternative 6	Fish Passage at J.C. Boyle, Remove Copco 1, Copco 2, and Iron Gate	Remove Copco 1, Copco 2, and Iron Gate Dams, construct upgraded fish passage at J.C. Boyle.	The EIS/EIR will fully analyze effects of removing all dams, constructing fish passage facilities at all dams, and a combination of these measures as a part of Alternatives 2, 4, and 5. Potential effects of Alternative 6 will be fully analyzed through these other alternatives. Alternative 6 will not move forward for further analysis.
Alternative 7	Sequenced Removal of Four Dams	Sequence dam removal over three to five years.	Alternative 7 will not be carried forward for more detailed analysis in the EIS/EIR because it would not reduce environmental effects of the Proposed Action, and may increase effects to fish associated with sediment release from the reservoirs over multiple years.

Table 2-2. Initial Alternatives

Alternative Number	Alternative Name	Description	Screening Result
Alternative 8	Full Facilities removal of Four Dams without KBRA	Remove four dams and related facilities but do not implement KBRA elements.	Alternative 8 will not be carried forward for more detailed analysis in the EIS/EIR because it does not meet most of the purpose and need/project objectives and would not reduce environmental effects of the Proposed Action. The effects of removing the four dams and related facilities will be fully analyzed under Alternative 2.
Alternative 9	Trap and Haul Fish	Capture fish at Iron Gate Dam and transport them upstream of J.C. Boyle Dam.	Alternative 9 will not move forward for further analysis because it does not meet the purpose and need under NEPA or most of the project objectives under CEQA.
Alternative 10	Fish Bypass: Bogus Creek Bypass	Create fish bypass using Bogus Creek, Cold Creek, Little Deer Creek, and a constructed canal to connect to Copco 1 Reservoir.	Alternative 10 will not move forward for more detailed analysis in the EIS/EIR because it does not meet any elements of the purpose and need under NEPA or project objectives under CEQA.
Alternative 11	Fish Bypass: Alternative Tunnel Route	Create fish bypass using Bogus Creek and a 5-mile tunnel to connect to Copco Reservoir.	Alternative 11 will not move forward for more detailed analysis in the EIS/EIR because it does not meet any elements of the purpose and need under NEPA or project objectives under CEQA.
Alternative 12	Notching Four Dams	Notch four dams to create a free-flowing river.	Alternative 12 is very similar to Alternative 3, and would result in the same type of impacts. Therefore, this alternative will not move forward for more detailed analysis in the EIS/EIR as a separate alternative.
Alternative 13	Federal Takeover of Project	Use authority of the Federal Power Act for government to take over dams and initiate removal.	Alternative 13 will not move forward for more detailed analysis in the EIS/EIR because the environmental impacts would be generally the same (and have generally the same timeframe) as those under Alternative 2.
Alternative 14	Full Removal of Five Dams	Remove Keno Dam in addition to four downstream dams.	Alternative 14 will not be carried forward for more detailed analysis in the EIS/EIR because it does not fully meet the purpose and need/project objectives (because it is not consistent with the KHSA) and it would not avoid or lessen potential adverse environmental effects of the Proposed Action.
Alternative 15	Full Removal of Six Dams	Remove Keno and Link River Dams in addition to four downstream dams.	Alternative 15 will not be carried forward for more detailed analysis in the EIS/EIR because it does not fully meet the purpose and need/project objectives (because it is not consistent with the KHSA) and it would not avoid or lessen potential environmental effects of the Proposed Action. Implementation of Alternative 15 would also not be likely to meet Endangered Species Act requirements or tribal trust water rights within Upper Klamath Lake.
Alternative 16	Dredge Upper Klamath Lake	Remove sediments in Upper Klamath Lake to remove phosphorus and increase storage capacity.	Alternative 16 will not move forward for more detailed analysis in the EIS/EIR because it does not meet the purpose and need under NEPA or most of the project objectives under CEQA.

Table 2-2. Initial Alternatives

Alternative Number	Alternative Name	Description	Screening Result
Alternative 17	Predator Control	Control seal, sea lion, and cormorant populations that are salmonid predators.	Alternative 17 will not move forward for more detailed analysis in the EIS/EIR because it does not meet the purpose and need under NEPA or project objectives under CEQA. Moreover, it would be difficult to permit because of biological concerns.
Alternative 18	Partition Upper Klamath Lake	Create an "inner lake" that may improve water quality.	Alternative 18 will not move forward for more detailed analysis in the EIS/EIR because it does not meet the purpose and need under NEPA or project objectives under CEQA.

Key:
CEQA: California Environmental Quality Act
EIS/EIR: Environmental Impact Statement/Environmental Impact Report
FEIS: Federal Energy Regulatory Commission Environmental Impact Statement
FERC: Federal Energy Regulatory Commission
KBRA: Klamath Basin Restoration Agreement
KHSA: Klamath Hydroelectric Settlement
NEPA: National Environmental Policy Act

The Klamath Hydroelectric Settlement Agreement (KHSA) Section 3.2.1(iii), signed by Secretary of the Interior Ken Salazar on February 18, 2010, directs the Secretary to undertake environmental review in support of the Secretarial Determination. All alternatives carried forward for further analysis in the EIS/R were analyzed using existing studies and other appropriate data as suggested in KHSA Section 3.2.1 (i), where such analysis met criteria in (40 CFR 1502.22 and 43 CFR 46.125) to incorporate available information. As part of developing the basis for the Secretarial Determination, the KHSA requires in Section 3.3.2 that the Secretary prepare a Detailed Plan, including the identification, qualifications, management, and oversight of a non-federal DRE, if any, that the Secretary may designate. KHSA Section 3.3.4.D requires that an estimate of costs be prepared as part of the Detailed Plan. The Detailed Plan analysis provides most of the information for the project description for Alternatives 2 and 3, and this information was used to analyze these two action alternatives. As described in KHSA Section 3.2.1(i), the FERC record is used to form the project description for Alternatives 4 and 5. Alternatives 4 and 5 were analyzed to ensure that the review of reasonable fish passage alternatives was comprehensive. In addition, at the time of developing a reasonable range of alternatives, the lead agencies recognized that the inclusion of Alternatives 4 and 5 would provide an assessment of the short- and long-term effects from a broader range of reasonable alternatives, as defined under CEQA. Alternatives 4 and 5 are outside the authority of the Department of the Interior, the four facilities proposed for removal are privately owned structures, and there was no provision in the KHSA to include them in the Detailed Plan. The result is differing levels of available information for alternatives carried forward in the EIS/R consistent with the elements of each action alternative.

As a result of the initial alternative screening, four action alternatives and the No Action/No Project alternative were selected to move forward for analysis in the EIS/EIR. Table 2-3 presents the alternatives carried forward for analysis in the EIS/EIR. These alternatives represent a reasonable range of alternatives for analysis to provide context for decision-makers. Analysis

of these alternatives will provide the Secretary with information needed to make a decision, and potentially to mix and match elements of the alternatives, if needed, to create an alternative that would reduce environmental impacts and increase environmental benefits.

Table 2-3. Alternatives Selected for Analysis in EIS/EIR

Alternative Number	Alternative Name	Description
Alternative 1	No Action/ No Project	Implement none of the action alternatives; Klamath Hydroelectric Project would continue current operations.
Alternative 2	Full Facilities Removal of Four Dams (Proposed Action)	Remove four dams and related facilities.
Alternative 3	Partial Facilities Removal of Four Dams	Remove main areas of four dams to allow a free-flowing river and volitional fish passage; related facilities and/or abutments may remain.
Alternative 4	Fish Passage at Four Dams	Construct fish passage facilities to provide upstream and downstream passage at four dams.
Alternative 5	Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate	Remove Copco 1 and Iron Gate Dams, construct fish passage at J.C. Boyle and Copco 2 Dams.

2.4 Proposed Action and Alternatives

The following sections describe the alternatives under evaluation in this EIS/EIR. Appendix A includes more detailed descriptions of these alternatives.

2.4.1 Facilities Common to All Alternatives

All of the alternatives, except for the No Action/No Project Alternative, include actions at the Four Facilities of the Klamath Hydroelectric Project: the J.C. Boyle, Copco 1, Copco 2, and Iron Gate dam sites. Table 2-4 outlines characteristics of the Four Facilities.

Table 2-4. Dam and Powerhouse Components

	J.C. Boyle	Copco 1	Copco 2	Iron Gate
Dam type	Concrete and earthfill embankment	Concrete	Concrete	Earthfill embankment
Dam maximum height	68 feet	135 feet	33 feet	189 feet
Dam crest length	692 feet	410 feet	335 feet	740 feet
Reservoir surface area	420 acres	1,000 acres	N/A	944 acres
Reservoir storage volume	2,629 acre-feet	40,000 acre-feet	73 acre-feet	53,800 acre-feet
Type of facility to allow water to flow past dam	Overflow spillway with control gates and diversion culvert	Overflow spillway with control gates and diversion tunnel	Overflow spillway with control gates	Uncontrolled overflow spillway and diversion tunnel

Source: Federal Energy Regulatory Commission (FERC) 2007; Department of the Interior (DOI) 2011

Each of the facilities generates power using various methods for water delivery to the power generation facility as summarized in Table 2-5.

Table 2-5. Power Generation Facilities

	J.C. Boyle	Copco 1	Copco 2	Iron Gate
Type of facility to divert water for power generation	Concrete tower with screened water intake	Intakes at upstream end of dam	Diversion intake with gate	Concrete tower with water intake
Water conveyance system to power generation facility	638 feet of steel pipe (14-foot diameter), 2 mile concrete flume, 1,660 foot tunnel, and into two 10.5 foot penstock pipes 956 feet long	Two 10-foot and one 14-foot diameter penstock pipes	2,440 feet of concrete-lined tunnel, 1,313 feet of wood-stave pipeline, 1,110 feet of additional concrete-lined tunnel, and into two penstock pipes (16-foot diameter)	One 12-foot diameter penstock pipe
Power generation mechanism	2 turbines	2 turbines	2 turbines	1 turbine
Powerhouse Type	Concrete foundations with concrete pads for access, no building	Enclosed building	Enclosed building	Concrete foundations with concrete pads for access, no building
Power Capacity	98 MW	20 MW	27 MW	18 MW

Source: FERC 2007; DOI 2011

Key:

MW: megawatt

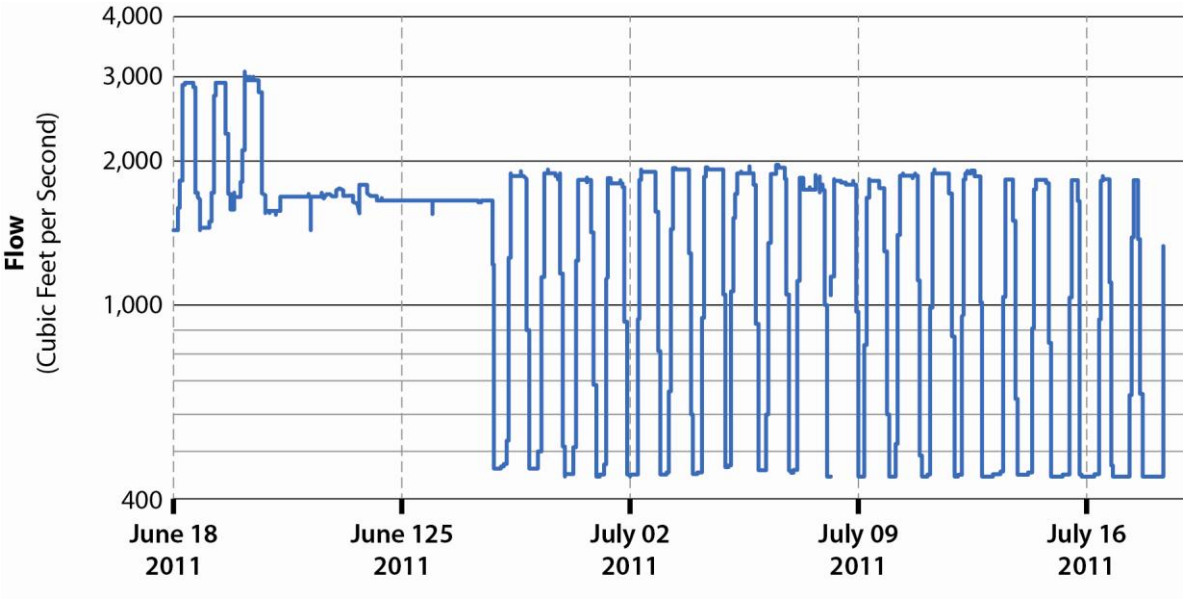
2.4.1.1 J.C. Boyle Dam and Powerhouse

The J.C. Boyle facilities consist of a reservoir, embankment dam, concrete spillway, fish ladder, water intake structure, water conveyance system, and powerhouse. The narrow reservoir is created by an embankment dam with a concrete spillway as shown in Figure 2-2. The concrete spillway has flow control gates on the crest along with a fish ladder and water intake structure for diverting water to power generation facilities. The water conveyance system transmits diverted water several miles downstream to the powerhouse on the Klamath River.

At J.C. Boyle Dam, a portion of Klamath River flow is diverted into the power generation system and the non-diverted water is used to maintain flow in the fish ladder with the excess flow going over the spillway as necessary. The fish ladder discharge and spillway discharge combine and flow through the section of river referred to as the "Bypass Reach," which contains less flow than other sections of the river. Water diverted at the dam for power generation is conveyed through a steel pipe, concrete canal, tunnel, and penstock pipe to the powerhouse. The powerhouse is approximately four river miles downstream from the dam. After water runs through the power generation facilities, it rejoins the Klamath River.

Figure 2-2. J.C. Boyle Dam and Powerhouse

J.C. Boyle powerhouse is generally operated as a peaking facility when river flows are too low to allow for continuous operations, such as the summer low flow period. Power demand peaks during weekday afternoons in the summer. Peaking power generation occurs in the late afternoons and early evenings to meet this demand, which allows the reservoir to refill during the night when power demand is minimal. Figure 2-3 shows early summer flows in 2011 as an example of how peaking operations affect flow downstream of the powerhouse. The reach between the powerhouse and the upstream end of Copco 1 Reservoir is referred to as the "Peaking Reach." Historically, flows in this reach fluctuated rapidly to meet demand and peaking operations for power generation.



Source: USGS 2011

Figure 2-3. Example Flows in Peaking Reach downstream from J.C. Boyle Powerplant (United States Geological Survey [USGS] station 11510700)

2.4.1.2 Copco 1 Dam and Powerhouse

Copco 1 Dam (Figure 2-4) is in a bedrock canyon on the Klamath River at River Mile (RM) 198.6. Construction records show that the concrete dam includes 465 tons of 30-pound steel rails for reinforcement.

Water is routed past the dam, through the power generation facilities, and/or over the concrete spillway. Water diversion for power generation is via two intake structures on the right dam abutment (these descriptions refer to river right and river left when looking downstream). Water flows into the intakes and down to the powerhouse, located at the base of the dam, through steel penstock pipes. Excess water not diverted for power generation is allowed to flow over the concrete spillway and down the face of the dam. The entire width of the dam creates the spillway, which is controlled by gates that run across the top of the spillway. Water that flows over the spillway rejoins water diverted for power generation near the base of the dam at the powerhouse.

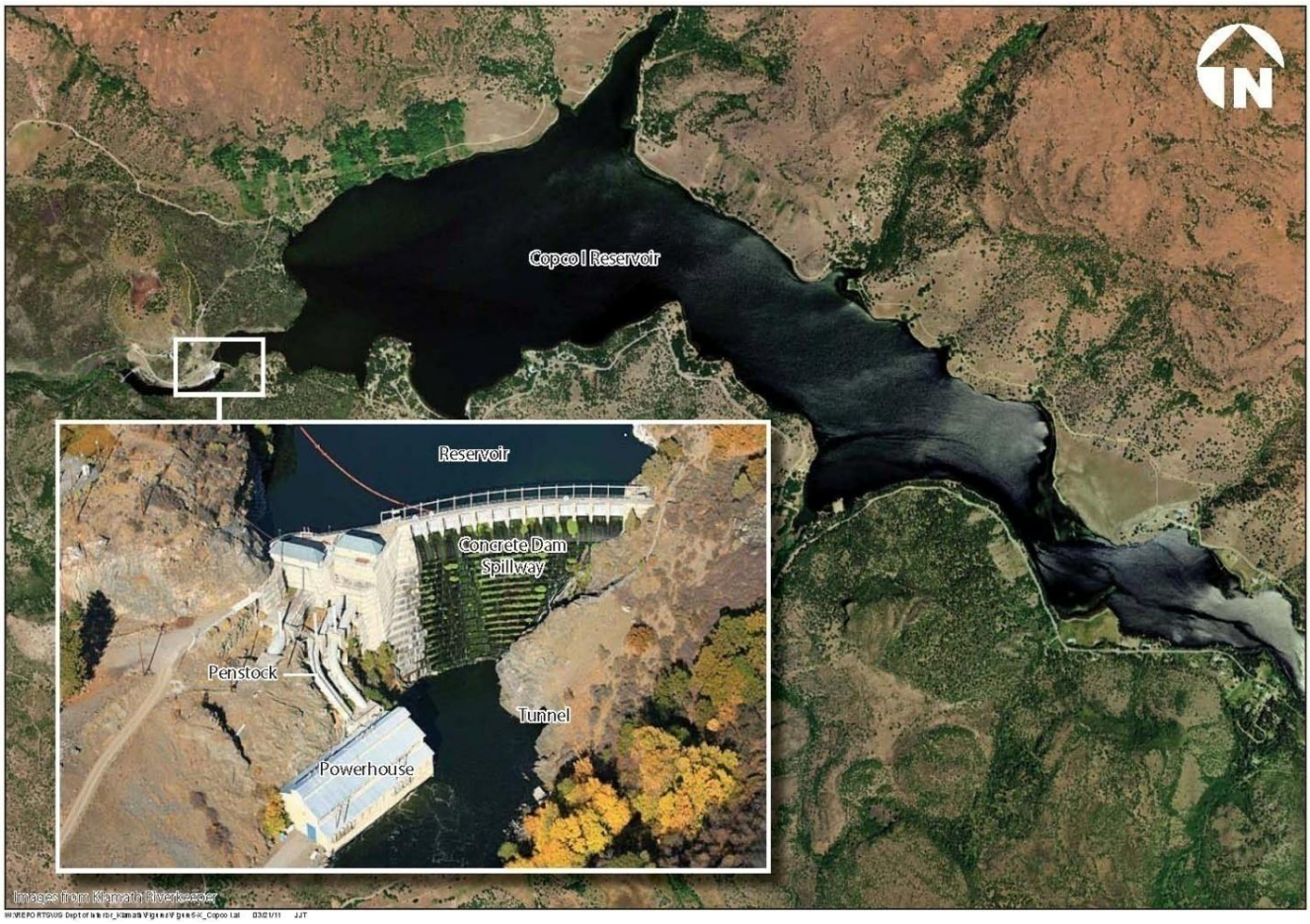


Figure 2-4. Copco 1 Dam and Powerhouse

2.4.1.3 Copco 2 Dam and Powerhouse

The Copco 2 facilities consist of a concrete dam, water diversion intake, water conveyance system for power generation, penstock pipes, powerhouse, and switchyard. The dam is at the bottom of a confined canyon on the Klamath River at RM 198.3. Copco 2 Dam is a concrete dam that spans the river with an earthen embankment section that fully spans the bottom of the canyon (see Figure 2-5).

At Copco 2 Dam, flow is diverted on river left through a water intake structure and conveyed through the power generation system. River flow in excess of diverted water is allowed to flow over the concrete spillway. An existing metal flume through the dam provides an additional 5 cubic feet per second (cfs) to the Bypass Reach below the dam.

Copco 2 Powerhouse is 1.5 miles downstream of Copco 2 Dam. Diverted river water flows from the dam through 2,440 feet of concrete-lined tunnel, 1,313 feet of pipeline, an additional 1,110 feet of concrete-lined tunnel, and two steel penstocks.

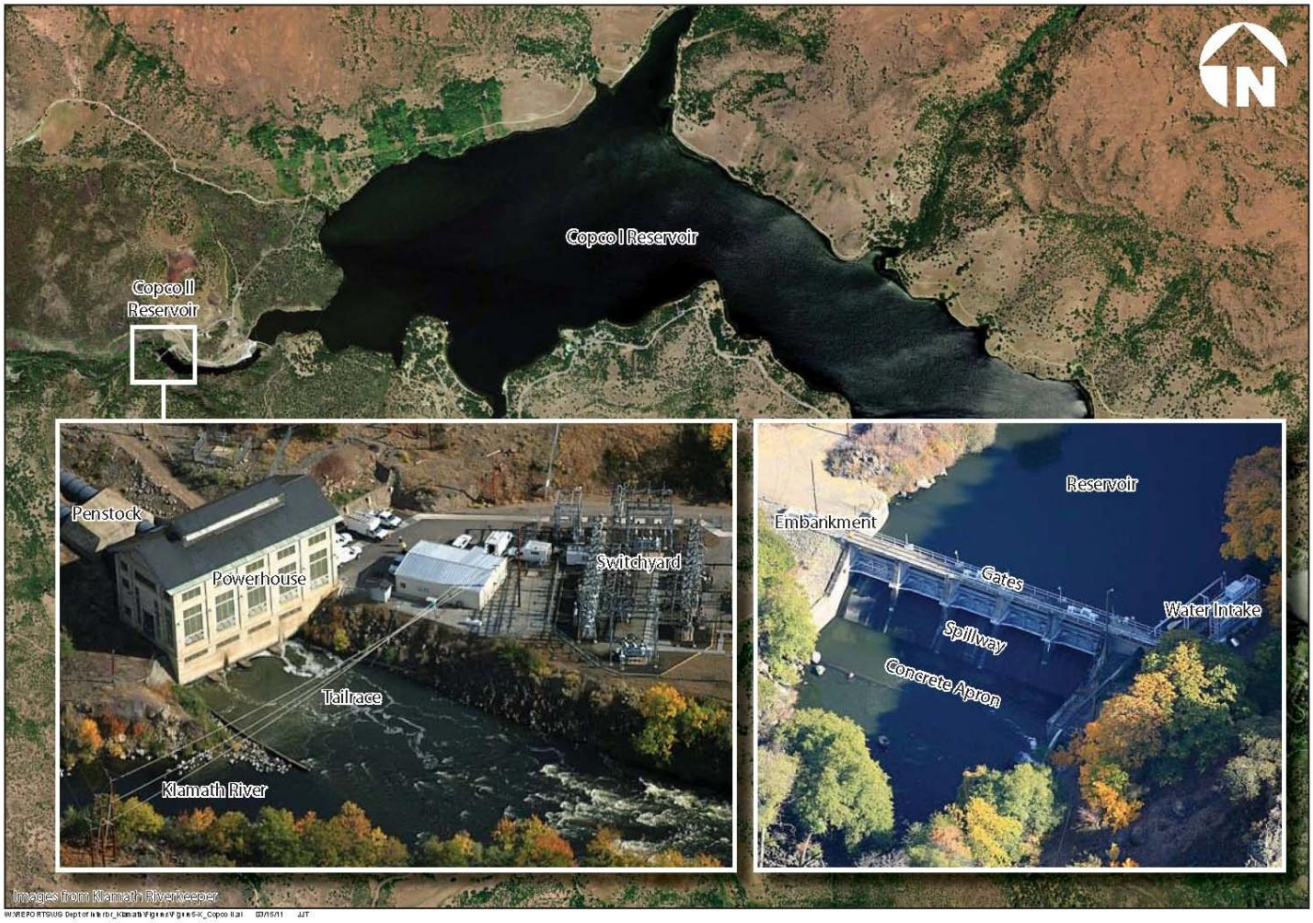


Figure 2-5. Copco 2 Powerhouse (left photo) and Dam

2.4.1.4 Iron Gate Dam and Powerhouse

The Iron Gate facilities consist of a reservoir, earthfill embankment dam, concrete spillway, water intake structure, penstock pipes, and power generation facility (see Figure 2-6). The embankment dam is in a bedrock canyon at RM 190.1.

Water for power generation is drawn from the reservoir using a concrete water intake tower on the left side of the reservoir. Water is transported down the face of the dam through penstock pipes and into the powerhouse immediately downstream of the dam on the left bank of the river. The powerhouse consists of one turbine with concrete structural slabs and no overhead building structure.

Water not diverted for power generation is allowed to flow freely over the concrete spillway on the right side of the dam. There are no gates or flow controls for the spillway and flow is directed to the base of the dam where it converges with power generation return flows to resume flow down the Klamath River. The Iron Gate Dam has the original bypass tunnel used during construction of the dam that allows water in the reservoir to be drawn down over 125 feet.

Figure 2-6. Iron Gate Dam, Reservoir, and Power Generating Facilities

2.4.2 Alternative 1: No Action/No Project Alternative

NEPA requires an EIS to "include the alternative of no action" (40 CFR Part 1502.14(d)). CEQA requires an EIR to include a No Project Alternative. CEQA Guidelines Section 15126.6(e)(2) states that "The 'no project' analysis shall discuss the existing conditions at the time the notice of preparation is published, or if no notice of preparation is published, at the time environmental analysis is commenced, as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services." For the Klamath Facilities Removal EIS/EIR, NEPA's No Action Alternative and CEQA's No Project Alternative describe the same conditions, and this alternative is referred to as the No Action/No Project Alternative.

The No Action/No Project Alternative represents the state of the environment without the Proposed Action or any of the alternatives. In this instance, the No Action/No Project Alternative would be no change from current management conditions, other than as noted below, with the dams remaining in place. The No Action/No Project Alternative would only include the

portions of the KBRA that are ongoing resource management activities. These resource management actions could receive additional funding and could be expanded or accelerated through the KBRA; however, they were started or under consideration before the KBRA was developed and would move forward even without the KBRA. Therefore, the No Action/No Project Alternative includes the following resource management actions:

- **Williamson River Delta Project** - As part of this project, levees were breached on Williamson River in November 2008 to provide 28,800 acre-feet of additional storage in Upper Klamath Lake.

- **Agency Lake and Barnes Ranches Project** – The diked and drained portion of the ranches are currently used by Reclamation as pumped storage. The lands have been transferred from Reclamation to the United States Fish and Wildlife Service (USFWS) so that the dikes can be breached to reconnect wetlands to Upper Klamath Lake and add 63,770 acre feet of storage Upper Klamath Lake. USFWS is studying options to breach the dikes.

- **Fish Habitat Restoration -** restoration activities are ongoing throughout the basin under current authorities and funding levels. These restoration activities include, but are not limited to, restoration and permanent protection of riparian vegetation, water quality improvements, restoration of stream channel functions, measures to prevent and control excessive sediment inputs, remediation of fish passage problems, and prevention of entrainment into diversions. Specific types of activities include floodplain rehabilitation, large woody debris placement, fish passage correction, cattle exclusion, riparian vegetation planting, mechanical thinning to promote conifers, fire treatment, purchase of conservation easements/land, road decommissioning, gravel augmentation (main stem), and treatment of fine sediment sources. The fish habitat restoration program that would be implemented under the KBRA would include these same types of activities but is described under the Proposed Action.

- **Climate Change Assessment –** this assessment is intended to ensure that long-term climate change in the Klamath Basin is assessed early and continuously, allowing the Parties to collaboratively respond in a manner that protects basin interests from the adverse effects of climate change for as long as practicable, and to manage the resources of the basin on the basis of the best available science.

The KHSA outlines 20 Interim Measures (IMs) for the Klamath Hydroelectric Project that would be implemented until construction begins (if the Secretary makes an Affirmative Determination). Under the No Action/No Project Alternative, the KHSA would not move forward. However, several of these IMs have already been implemented, or would likely be implemented with a Negative Determination. Table 2-6 includes the IMs that are part of the No Action/No Project Alternative because:

- IMs are included in PacifiCorp's proposed Habitat Conservation Plan (National Oceanic and Atmospheric Administration [NOAA] Fisheries Service 2011) (IMs 2, 4, 5, 6, and 13);

- IMs are included in an Environmental Assessment from BLM and are scheduled to move forward before the Secretary makes a determination (IMs 7 and 8); or

- IMs represent a continuation of existing operations (IMs 14 and 17).

IM 7 (J.C. Boyle Gravel Placement) would start before the Secretary makes a determination, but it would end with a Negative Determination. Gravel placement would occur for approximately one year under the No Action/No Project Alternative before a determination is made; therefore, only one year of implementation of IM 7 is included in the No Action/No Project Alternative. IMs 3 (Iron Gate Turbine Venting) and 12 (J.C. Boyle Bypass Reach and Spencer Creek Gaging) have already been implemented and are therefore part of existing conditions. The remaining IMs would end with a Negative Determination and are not included in the No Action/No Project Alternative.

Table 2-6. Interim Measures included in the No Action/No Project Alternative

Interim Measure	Description
IM2 – California Klamath Restoration Fund/Coho Enhancement	PacifiCorp would fund actions to enhance survival and recovery of coho salmon, including habitat restoration and acquisition.
IM4- Hatchery and Genetics Management Plan	PacifiCorp would fund the development and implementation of a Hatchery and Genetics Management Plan for the Iron Gate Hatchery.
IM5- Iron Gate Flow Variability	PacifiCorp and Reclamation would annually evaluate the feasibility of enhancing fall and early winter flow variability to benefit salmonids downstream of Iron Gate Dams. In the event that fall and early winter flow variability can feasibly be accomplished, PacifiCorp would develop and implement flow variability plans. This IM would not adversely affect the volume of water available for Reclamation's Klamath Project or wildlife refuges.
IM6- Fish Disease Relationship and Control Studies	PacifiCorp has established a fund to study fish disease relationships downstream of Iron Gate Dam. PacifiCorp would consult with the Klamath River Fish Health Workgroup regarding selection, prioritization, and implementation of such studies.
IM7- J.C. Boyle Gravel Placement and/or Habitat Enhancement (one year only)	PacifiCorp would provide funding for the planning, permitting, and implementation of gravel placement or habitat enhancement projects, including related monitoring, in the Klamath River above Copco Reservoir within 90 days of the effective date.
IM8 - J.C. Boyle Bypass Barrier Removal	PacifiCorp would remove the sidecast rock barrier approximately 3 miles upstream of the J.C. Boyle Powerhouse in the bypass reach. This IM would help with safe, timely, and effective upstream passage of Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout.
IM13 - Flow Releases and Ramp Rates	PacifiCorp would maintain current operations including instream flow releases of 100 cfs from J.C. Boyle Dam to the J.C. Boyle Bypass Reach and a 9-inch per hour ramp rate below the J.C. Boyle powerhouse prior to transfer of the J.C. Boyle facility.
IM14 - 3,000 cfs Power Generation	Upon approval by OWRD, PacifiCorp would continue maximum diversions of 3,000 cfs at J.C. Boyle Dam for power generation prior to decommissioning of the facility.
IM17 - Fall Creek Flow Releases	PacifiCorp would continue to provide a continuous flow release to the Fall Creek bypass reach targeted at 5 cfs.

Key:
IM: Interim Measure
OWRD: Oregon Water Resources Department

PacifiCorp is including these IMs in a Habitat Conservation Plan (HCP) and analyzing them in accompanying NEPA environmental documents, biological opinions, and findings documents for NOAA Fisheries Service and USFWS. These documents are intended to inform Federal Endangered Species Act (ESA) Section 10 Incidental Take Permits (ITPs) by NOAA Fisheries Service and USFWS for implementation of interim conservation measures and related project operations for a ten-year period. Further background is provided in the notices of availability for the ESA Section 10 permit applications and related Environmental Assessment (NOAA Fisheries Service 2011). BLM has completed an Environmental Assessment and Finding of No Significant Impact related to IMs 7 and 8 (BLM 2011).

PacifiCorp would need to obtain a long-term operating license from the Federal Energy Regulatory Commission (FERC) to replace the existing annual license. PacifiCorp would resume relicensing proceedings with FERC to obtain the required long-term operating license.

For the purposes of this analysis, the No Action/No Project Alternative would continue current operations with the dams remaining in place and PacifiCorp operating under the current annual license. The existing license has no requirements for additional fish passage or implementation of the prescriptions that are currently before FERC in the relicensing process. PacifiCorp would continue to operate the Iron Gate Hatchery under its current operations. Flows would remain similar to current flows. Figure 2-7 shows modeled future flows in a dry year (represented by the flows exceeded 90 percent of the time, or 90 percent exceedence), an average year (flows exceeded 50 percent of the time), and a wet year (flows exceeded 10 percent of the time). These exceedence plots do not represent a flow pattern in any specific year. A "90% exceedence" flow is a flow that would be exceeded 90 percent of the time; therefore, it is generally representative of a dry year because most years have greater flows. Biological opinions may change in the future as understanding of species or their populations changes; however, these changes are unknown at this time and not included in the hydrologic assumptions.

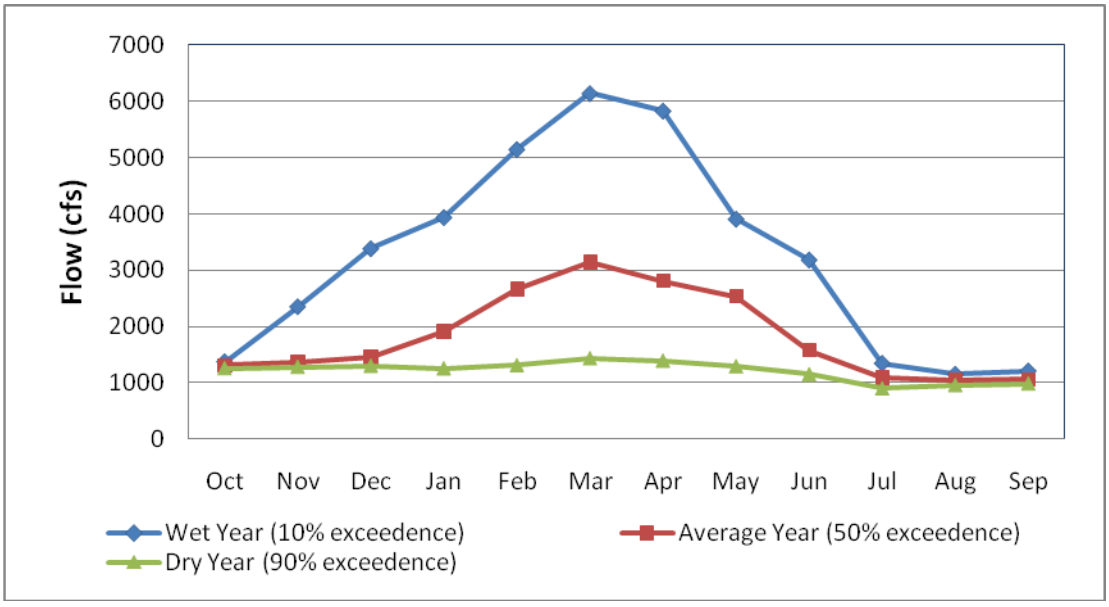


Figure 2-7. No Action/No Project Flows below Iron Gate Dam in Wet, Average, and Dry Years

The USFWS issued a biological opinion to Reclamation on the operation and maintenance of Reclamation's Klamath Project (USFWS 2008). This biological opinion outlines measures to improve the habitat for the Lost River sucker and shortnose sucker affected by Reclamation's Klamath Project operations. Among other measures to protect the suckers, the biological opinion requires that specific surface elevations of Upper Klamath Lake be maintained to meet certain criteria.

The National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries Service) also issued a biological opinion to Reclamation requiring releases from Reclamation's Klamath Project to produce specified rates of flow for the Klamath River downstream of Iron Gate Dam, based on the habitat needs of coho salmon (NOAA Fisheries Service 2010). Target flow rates in the Klamath River downstream of Iron Gate Dam vary by month, and are dependent in part on the amount of water entering Upper Klamath Lake.

PacifiCorp would continue to coordinate operations with Reclamation and operate the Klamath Hydroelectric Project in compliance with existing NOAA Fisheries Service and USFWS biological opinions issued for Reclamation's Klamath Project. Under the No Action/No Project Alternative, the Four Facilities would continue to be subject to requirements in PacifiCorp's current annual FERC permit:

- Operating the peaking facility at J.C. Boyle such that the river does not rise or fall more quickly than 9 inches per hour and that minimum flows immediately downstream of the dam are maintained at 100 cfs.
- Maintaining minimum flows downstream of Iron Gate Dam.
- Limiting the change in the rate of the release of water from Iron Gate Dam to no more than 250 cfs per hour or a three-inch change in river stage. (FERC 2007)

PacifiCorp also currently coordinates with Reclamation to meet ramp rates in the NOAA Fisheries Service biological opinion on Reclamation's Klamath Project:

- When flows at Iron Gate Dam are 3000 cfs or above, Iron Gate Dam ramp down rates will follow the rate of decline to inflows to Upper Klamath Lake combined with accretions between Keno Dam and Iron Gate Dam.
- When flows at Iron Gate Dam are between 1,750 cfs and 3,000 cfs, Iron Gate Dam ramp down rates will be 300 cfs or less per 24 hour period and no more than 125 cfs per 4 hour period.
- When flows at Iron Gate Dam are 1,750 cfs or less, Iron Gate ramp down rates will be 150 cfs or less per 24 hour period and no more than 50 cfs per two hour period. (NOAA Fisheries Service 2010)

The No Action/No Project Alternative would include other regulatory conditions that would affect conditions in the Klamath Basin. To improve water quality, the Oregon Department of Environmental Quality (ODEQ) and California North Coast Regional Water Quality Control Board (NCRWQCB) cooperated to develop Total Maximum Daily Loads (TMDLs) for impaired water bodies within the basin. TMDLs are pollution control plans that identify the pollutant load reductions that are necessary from point and nonpoint sources to meet water quality standards.

Table 2-7 shows the status of the TMDLs in the Klamath basin. The California and Oregon Klamath River TMDLs focus on reducing high water temperatures, increasing dissolved oxygen levels, and reducing nutrient concentrations in the mainstem Klamath River (NCRWQCB 2010a, ODEQ 2010). Major tributaries in the lower Klamath Basin, such as the Scott, Shasta, and Trinity Rivers, are not included in the technical analyses (i.e., modeling efforts) for the California Klamath TMDLs but the entire Klamath Basin is included in the associated Implementation Plan (NCRWQCB 2010b).

Table 2-7. Status of TMDLs in the Klamath River Basin

Water Body	Pollutant/Stressor	Agency	Original Listing Date	TMDL Completion Date[1]
Oregon				
Upper Klamath Lake Drainage	Temperature, dissolved oxygen, and pH	ODEQ	1998	2002
Upper Klamath and Lost Rivers	Temperature, dissolved oxygen, pH, ammonia toxicity, and chlorophyll-*a*	ODEQ	1998	2011
California				
Lower Lost River[2]	pH and nutrients	USEPA	1992	2008
Klamath River	Temperature, organic enrichment/low dissolved oxygen, nutrient, and microcystin	NCRWQCB	1996, 1998, 2006, and 2008	2010
Shasta River	Temperature and dissolved oxygen	NCRWQCB	1998 and 2008	2007
Scott River	Temperature and sediment	NCRWQCB	1992, 1996, and 1998	2006
Salmon River	Temperature	NCRWQCB	1996	2005
Trinity	Sediment	USEPA	1994 and 2006	2001
South Fork Trinity	Sediment	USEPA	1994 and 2002	1998

Notes:

[1] The TMDL completion date is the year the USEPA approved or is expected to approve the TMDL.

[2] The Upper Lost River upstream of the Oregon border, Clear Lake Reservoir, and tributaries are listed for water temperature and nutrients. In 2004, North Coast Regional Board staff completed an analysis of beneficial uses and water quality conditions in the Upper Lost River watershed and concluded that the listing is not warranted.

Key:

TMDL: Total Maximum Daily Load

ODEQ: Oregon Department of Environmental Quality

USEPA: U.S. Environmental Protection Agency

NCRWQCB: North Coast Regional Water Quality Control Board

The TMDLs within the basin are expected to result in improvements to water quality conditions, but the improvements cannot be quantified due to uncertainties regarding the timing and magnitude of mitigation projects, necessary to achieve water quality standards. Section 3.2, Water Quality, describes these TMDLs in detail.

2.4.3 Alternative 2: Full Facilities Removal of Four Dams (Proposed Action)

The Full Facilities Removal of Four Dams Alternative (the Proposed Action) includes the removal of the Four Facilities as described in the KHSA. This alternative would include the complete removal of dams, power generation facilities, water intake structures, canals, pipelines, ancillary buildings, and dam foundations. During deconstruction the four reservoirs would be closed to recreation. This alternative would include the transfer of Keno Dam to the Department of the Interior (DOI), decommissioning of PacifiCorp's East Side/West Side facilities, and the implementation of the KBRA as connected actions as defined under NEPA.

The result of the Proposed Action would be that the Klamath River would have no dams downstream from Keno Dam. Operation of Reclamation's Klamath Project and the related river flows, measured at the United States Geological Survey gauge downstream from Iron Gate Dam, would be according to the hydrologic model outputs in KBRA Appendix E-5. Figure 2-8 shows simulated future flows at the Iron Gate Gauge during a dry year (represented by the flows exceeded 90 percent of the time, or 90 percent exceedence), an average year (flows exceeded 50 percent of the time), and a wet year (flows exceeded 10 percent of the time)[2].

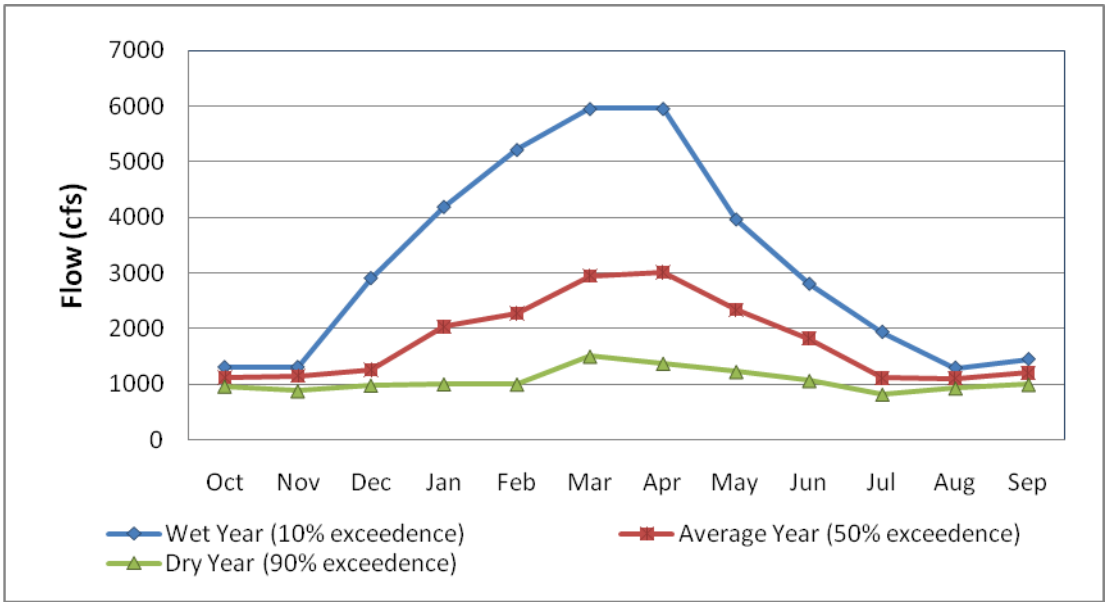


Figure 2-8. Proposed Action Flows at the Iron Gate Gauge in Wet, Average, and Dry Years

Removing the Four Facilities would release some of the sediment currently stored behind the dams into the downstream river system. Table 2-8 shows the quantity of sediment in Iron Gate,

[2] Minimum flows may change in the future. Hydrologic modeling assumed that the Drought Plan would include a minimum flow of 800 cfs (DOI 2011). The final Drought Plan or future ESA actions could change the minimum flows; however, these assumptions reflect the best available information at the time of the modeling.

Copco 1, and J.C. Boyle reservoirs; the sediment in storage in Copco 2 reservoir is negligible. The sections below describe how much sediment would erode from each site.

Reservoir drawdown schedules were selected to minimize release of sediment during critical times for sensitive species. The lead agencies studied multiple drawdown scenarios to optimize performance for these sensitive fish. The challenge in selecting a drawdown period was to avoid impacts to migrating adult fish (salmonids, sturgeon, and lamprey), migrating juvenile smolts, and rearing of juveniles. During summer, there are juveniles rearing, green sturgeon adults, and spring-run Chinook salmon migrating. During fall, there are adult coho salmon, steelhead, and fall-run Chinook salmon migrating, and smolts outmigrating. During spring, there are smolts outmigrating, adult green sturgeon, and steelhead and spring-run Chinook adults migrating. Drawdown would primarily occur during winter because it would be the least harmful season; however, there are still species and life stages that may be affected, such as adult migrating steelhead and lamprey.

Table 2-8. Sediment Stored In Reservoirs

Reservoir	Source area[1] (acres)	Period of Sediment Accumulation	Sediment Accumulation Volume (yd^3)
Iron Gate	135,680	40 yr (1962-2002)	4,700,000
Copco 1	174,720	84 yr (1918–2002)	7,400,000
J.C. Boyle	144,000	44 yr (1958–2002)	1,000,000
Total			**13,100,000**

Key:
yd^3: cubic yards
yr: Year
Source: Department of the Interior 2011
Notes:
[1] Source Area refers to the sub basin that drains to the reservoir.

Prior to construction, IMs as described in the KHSA (KHSA Section 1.2.4) would be implemented and would control operations of the hydroelectric facilities. Some of these IMs would be implemented in the No Action/No Project Alternative, but the remaining would be included in the Proposed Action. Some of the IMs propose studies, planning efforts, or the continued funding of existing facilities that do not constitute new actions with the potential to affect the environment and are therefore not analyzed in this EIS/EIR. Table 2-9 presents these IMs included in the Proposed Action that would not result in environmental effects.

Table 2-9. KHSA Interim Measures that would not produce Environmental Effects

Interim Measure	Description
IM9 – J.C. Boyle Powerhouse Gage	PacifiCorp would fund the continued operation of the existing gage below J.C. Boyle Powerhouse.
IM10 – Water Quality Conference	PacifiCorp would fund a basin-wide technical conference on water quality.
IM15 – Water Quality Monitoring	PacifiCorp would fund long-term baseline water quality monitoring to support dam removal, nutrient removal, and permitting studies, and would also fund blue-green algae and toxin monitoring.
IM 18 – Hatchery Funding	PacifiCorp would fund Iron Gate Hatchery operations and maintenance.
IM21 - BLM Land Management Provisions	PacifiCorp would fund BLM's continued land management activities including road maintenance, invasive weed management, cultural resource management, and recreation.

Key:
IM: Interim Measure
BLM: Bureau of Land Management

The remaining IMs are also included in the Proposed Action and will be analyzed in Chapter 3 of this EIS/R (see Table 2-10). As discussed under the No Action/No Project Alternative, one year of IM7 would be implemented before the Secretary makes a determination. The remaining seven years, however, would only occur in the case of an Affirmative Determination and are therefore included in the Proposed Action.

2.4.3.1 Deconstruction Actions

J.C. Boyle Dam and Powerhouse

Full removal of the J.C. Boyle Dam and Powerhouse would include removal of the dam, spillway and gates, powerhouse, powerhouse equipment, and concrete fish ladder. This alternative would also include removal of ancillary facilities, such as the canal and pipeline that convey water to the powerhouse. The extensive headcut downstream of the forebay overflow discharge canal would be filled and stabilized with a portion of the material removed from the dam structure. Further, the dam removal entity (DRE) would fill the tailrace (where the powerhouse discharges water) to restore natural river conditions in this area. In order to access the dam for deconstruction, the DRE would perform a controlled reservoir drawdown using the spillway gates, conveyance pipeline and canal, and diversion conduit.

The deconstruction process would begin by gradually drawing down the reservoir. Reservoir drawdown would release water into the concrete canal (the power generation intake), the spillway, and the bypass conduit through the dam depending on the water surface elevation in the reservoir. Water would flow through the Bypass Reach throughout reservoir drawdown. As the reservoir was drawn down, the DRE would remove facilities from the top down. The DRE would start by removing the spillway gates, the spillway bridge, and the upstream concrete intake structure for the powerhouse canal. The DRE would use cranes and excavators for removal, and might also need blasting to remove concrete facilities.

Table 2-10. KHSA Interim Measures Analyzed in the Proposed Action

Interim Measure	Description
IM7- J.C. Boyle Gravel Placement and/or Habitat Enhancement (final 7 years)	PacifiCorp would provide funding for the planning, permitting, and implementation of gravel placement or habitat enhancement projects, including related monitoring, in the Klamath River above Copco Reservoir within 90 days of the effective date.
IM11- Interim Water Quality Improvements	PacifiCorp would fund studies or pilot projects developed in consultation with the Implementation Committee regarding the following: • Development of a Water Quality Accounting Framework • Constructed Treatment Wetlands Pilot Evaluation • Assessment of In-Reservoir Water Quality Control Techniques • Improvement of J.C. Boyle Reservoir Dissolved Oxygen PacifiCorp would provide funding for implementation of projects approved by the ODEQ and the State and Regional Water Boards, and to cover project operation and maintenance expenses related to those projects.
IM16 - Water Diversions	PacifiCorp would seek to eliminate three screened diversions from Shovel and Negro Creeks and would seek to modify its water rights as listed above to move the points of diversion from Shovel and Negro Creeks to the mainstem Klamath River.
IM19 - Hatchery Production Continuity	PacifiCorp would evaluate hatchery production options that do not rely on the current Iron Gate Hatchery water supply. The study will assess groundwater and surface water supply options, water reuse technologies or operational changes that could support hatchery production in the absence of Iron Gate Dam. Based on the study results, PacifiCorp would propose a post-Iron Gate Dam Mitigation Hatchery Plan to provide continued hatchery production for eight years after the removal of Iron Gate Dam.[1]
IM20 - Hatchery Funding After Removal of Iron Gate Dam	After removal of Iron Gate Dam and for a period of eight years, PacifiCorp would fund 100 percent of hatchery operations and maintenance costs necessary to fulfill annual mitigation objectives developed by the DFG in consultation with the NOAA Fisheries Service.[1]

Key:
DFG: California Department of Fish and Game
IM: Interim Measure
KBRA: Klamath Basin Restoration Agreement
NOAA Fisheries Service: National Oceanic and Atmospheric Administration
ODEQ: Oregon Department of Environmental Quality
Notes:
1. Funding for IMs 19 and 20 would be a component of the Fish Reintroduction Plans under the KBRA (see Section 2.4.3.9).

The DRE would install a temporary cofferdam to isolate the work area near the spillway to continue deconstruction activities. To the extent possible, the DRE would use debris from deconstruction for the cofferdam. The cofferdams would likely be constructed using a combination of concrete rubble, rock, and earthen materials that would come from the dams. The cofferdam would isolate the left side of the dam to allow the DRE to deconstruct the concrete portion of the spillway using a hoe-ram (an excavator with a hydraulic hammering attachment) or by drilling and blasting. The DRE would also remove other concrete facilities (including the fish ladder, intake structure, power canal, forebay structures, and powerhouse) using a hoe-ram or drilling and blasting.

After reservoir drawdown, the DRE would remove the embankment dam, working from the top down with standard excavation equipment. The DRE would place portions of the excavated rockfill on the upstream embankment to create an isolation cofferdam. After removing the embankment, the DRE would breach the cofferdam and allow materials to naturally erode.

Estimated waste quantities for full facilities removal at the J.C. Boyle Development include 40,000 cubic yards (yd^3) of concrete, 140,000 yd^3 of earthfill, and 3,000 tons of mechanical and electrical items at the dam. The DRE would fill the original borrow pits on the right abutment of J.C. Boyle Dam with deconstruction waste. The DRE would haul materials on existing unpaved roads to the disposal sites along the cleared transmission line corridor, and place some material within ravines below the transmission lines (see Figure 2-9). The existing haul roads would require some initial clearing and minor improvements. The DRE would grade disposal sites for drainage and revegetate to prevent erosion.

The DRE would use surplus waste concrete and earth materials to fill the eroded scour hole on the hillside below the spillway structure to restore the area to near pre-dam conditions. For the remaining waste that would not be disposed on-site, the DRE would separate reinforcing steel from the concrete and haul the steel to a recycling facility in Klamath Falls, Oregon. The DRE would also haul mechanical and electrical equipment to Klamath Falls to be transferred to a suitable recycling facility outside the project boundaries.

Trapped sediments within the reservoir consist primarily of small particles of silts and clays that would be easily eroded and flushed out of the reservoir into the river. Modeling studies indicate that drawdown would erode and flush 41 to 65 percent of the stored sediment downstream during the drawdown period (DOI 2011). Once eroded from the reservoir, the fine sediment would continue to be suspended in the river water downstream to the ocean. Large quantities of sediment would remain in place after dam removal, primarily on areas above the active channel. The remaining sediments would consolidate (dry out and decrease in thickness) and would decrease the depth of the remaining sediment. Modeling studies show a change in sediment depth of up to 61 percent of original depth (DOI 2011). Similar shrinkage of sediment layers would be expected for Copco 1 and Iron Gate Reservoirs.

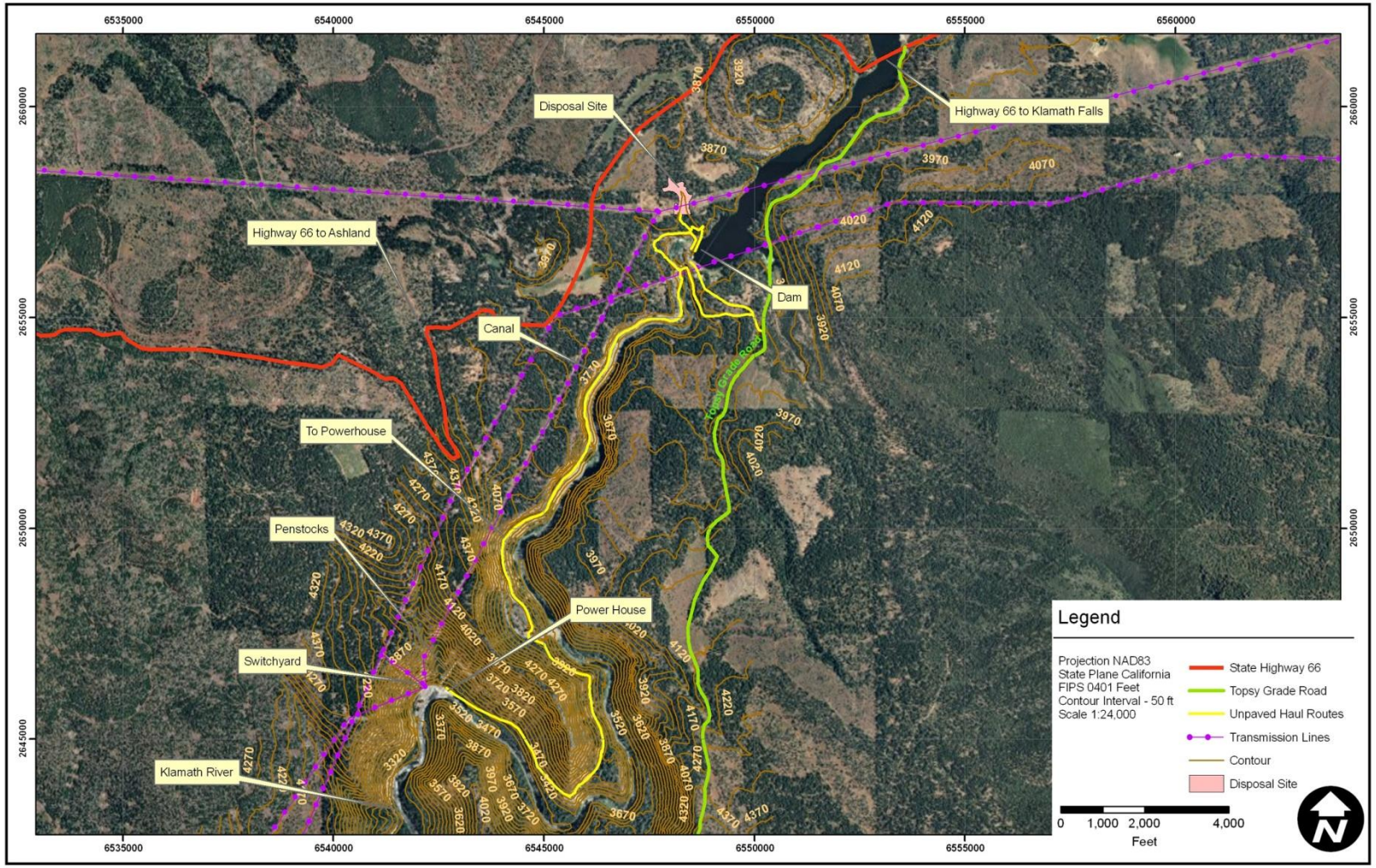


Figure 2-9. J.C. Boyle Haul Roads and Disposal Sites

Copco 1 Dam and Powerhouse

Under the Proposed Action, the DRE would remove the entire Copco 1 Dam from canyon wall to canyon wall and five feet below the existing streambed (a total of 130 feet from the top of the dam). Removing all facilities would include removal of the concrete water intake structure, concrete gate houses, penstock pipes and supports, powerhouse, power generation support facilities, switchyard, and unused transmission lines.

The deconstruction process would begin by gradually drawing down the reservoir. Reservoir drawdown would release water through three primary locations: over the spillway, through the penstock pipes, and through the diversion tunnel. Use of the diversion tunnel would require removal of three gates, three valves, and a concrete plug to make it operable. Three new gates would be placed on the diversion tunnel; these could be remotely operated. The concrete dam could safely allow flows that overtop the dam crest during dam removal without dam safety or flood concerns. The DRE would construct multiple "notches" in the dam to allow the reservoir to drain; the notches would be 20-foot wide openings that would be a minimum of 16 feet deep.

As the reservoir was drawn down, the DRE would remove facilities from the top down. The DRE would start by removing the spillway gates and the spillway deck bridge, using cranes and excavators. The DRE would then remove the concrete dam in 8-foot-high sections using drilling and blasting. Dam removal would be challenging because the dam has large boulders embedded in the concrete and is reinforced with steel rails.

After removal of the concrete dam down to the water level, the DRE would construct a cofferdam to isolate one side of the dam and remove water from the working area. The DRE would remove the dry portion of the dam to 5 feet below the existing riverbed and then divert the river through the new opening. The DRE would then isolate the other side of the dam and remove it. The DRE would use mechanical means (such as hydraulic shears that break concrete by shearing it like scissors or an excavator with a hoe-ram attachment) to excavate the reinforced concrete in deck, wall, and floor slabs for remaining features (including powerhouse and diversion intake structure).

The estimated waste quantity for Full Facilities Removal at Copco 1 Dam is 62,000 yd^3 of concrete and 1,200 tons of mechanical and electrical items at the dam and powerhouse. The DRE would remove debris from the dam deconstruction, including concrete rubble and reinforcing steel, using a large tower crane on the right side of the river. The DRE would bury concrete rubble on the right abutment within an on-site disposal area (see Figure 2-10). After disposal was complete, the DRE would grade the areas for drainage and revegetate to prevent erosion.

The DRE would separate reinforcing steel from the concrete and haul it to a local recycling facility in Yreka, California. The DRE would haul mechanical and electrical equipment to Yreka, California for transfer to a salvage company or disposal outside the project boundaries.

The concrete dam and powerhouse are in a steep, narrow canyon. The existing access roads would require substantial upgrades to handle the hauling of excavated concrete and provide access for a large, crawler-mounted crane. Crane access may also be available from the left abutment using existing unpaved roads.

Modeling studies indicate that the initial drawdown would flush 46 to 81 percent of the 7,440,000 yd^3 of silts and clays behind the dam (DOI 2011). Once eroded from the reservoir, the fine sediment would continue to be suspended in the river water downstream to the ocean. After drawdown, the remaining sediments would consolidate (dry out and decrease in thickness). Copco 1 Reservoir sediments would likely consolidate substantially, which would decrease the depth of the remaining sediment.

Copco 2 Dam and Powerhouse

The Proposed Action would include removal of the dam, spillway and gates, water intake structure, pipelines, penstock, power generation equipment, and unused transmission lines. The DRE would also reshape the embankment on river right to create a stable slope that blends into the natural hillslopes and river channel. Restoration would include filling in the tailrace channel between the powerhouse and the river to restore natural river conditions. The Copco 2 substation at the powerhouse and a switchyard on a bluff north of the river would remain in service following dam removal.

Because of the small reservoir size, a river diversion and work area isolation plan would be sufficient for dam removal. The DRE would start by removing the spillway gates and the spillway bridge using cranes and excavators. Next, the river flow would be lowered and routed through the spillway gates while a cofferdam would be constructed to isolate the left half of the dam. The river flow would be routed through the right two spillway gates as the left two spillway gates and spillway would be removed using mechanical techniques. The techniques would include use of hydraulic shears or hoe-ram attached to a track-hoe. The shears would be able to cut, or shear through the concrete like scissors while the hoe-ram is able to jackhammer the concrete into small pieces that can be removed. After the left spillway was removed, the river would be diverted through the vacated structure and the right portion of the dam would be removed using similar mechanical techniques. The remaining reinforced concrete walls and water intake structure on the side of the river would be removed after the dam is removed. The power generation water conveyance pipes and powerhouse would be removed using conventional track-hoes and off-road dump trucks.

Copco 2 Dam is a concrete dam in a confined canyon with poor access. The existing access roads would require substantial upgrades to handle the hauling of the excavated concrete and provide access for a large, crawler-mounted crane. The access bridge across the Klamath River downstream of the powerhouse could require improvements to handle the construction equipment loads.

Estimated waste quantities for full facilities removal at Copco 2 Dam and Powerhouse include more than 12,000 yd^3 of concrete, 1,500 yd^3 of earthfill, and 2,000 tons of mechanical and electrical items at the dam. The DRE would bury concrete rubble on the right abutment within an on-site disposal area (see Figure 2-10). The DRE would handle and dispose of reinforcing steel, concrete, and mechanical equipment in the same manner as removal of the Copco 1 facilities. Approximately 550 tons of creosote treated wood from the wood-stave conveyance pipe would have to be transported to an off-site disposal facility 120 miles from the site.

Iron Gate Dam and Powerhouse

The Proposed Action would include removal of the earthen dam, diversion tunnel gate structure, concrete water intake structure, powerhouse generation facility, penstock and its concrete supports, unused transmission lines, and the switchyard. The DRE would bury the concrete spillway to restore the pre-dam appearance of the right abutment bedrock canyon. Further, the DRE would fill the tailrace (where the powerhouse discharges water) to restore natural river conditions in this area.

The Proposed Action would include removal of the fish handling facilities at the base of the dam, but the Iron Gate Fish Hatchery would remain in place. PacifiCorp would need to identify and secure an alternate water source for the fish hatchery to remain operational because the water supply pipe from the penstock intake structure to the fish hatchery would be removed with the dam. PacifiCorp would fund eight years of hatchery operations after decommissioning of Iron Gate Dam, after which the parties will be responsible for identifying funding for continued operation.

The DRE would draw down the reservoir by releasing water through the bypass tunnel and into the power generation facilities. The DRE would begin excavation of the embankment on the very narrow top section, which would be a slow process because of the confined work area. As the excavation worked down from the top, the width of the excavation footprint would be wider and additional equipment could be used. The DRE would remove the riprap during embankment excavation. The DRE would then remove reinforced concrete from remaining structures (including intake structures, fish handling facilities, and powerhouse) using mechanical methods if possible (or drilling and blasting if necessary). The construction of temporary cofferdams would be necessary to divert water when removing the base of the dam and create isolated work areas. These cofferdams would be built using materials from the dam removal process and removed upon completion of the work.

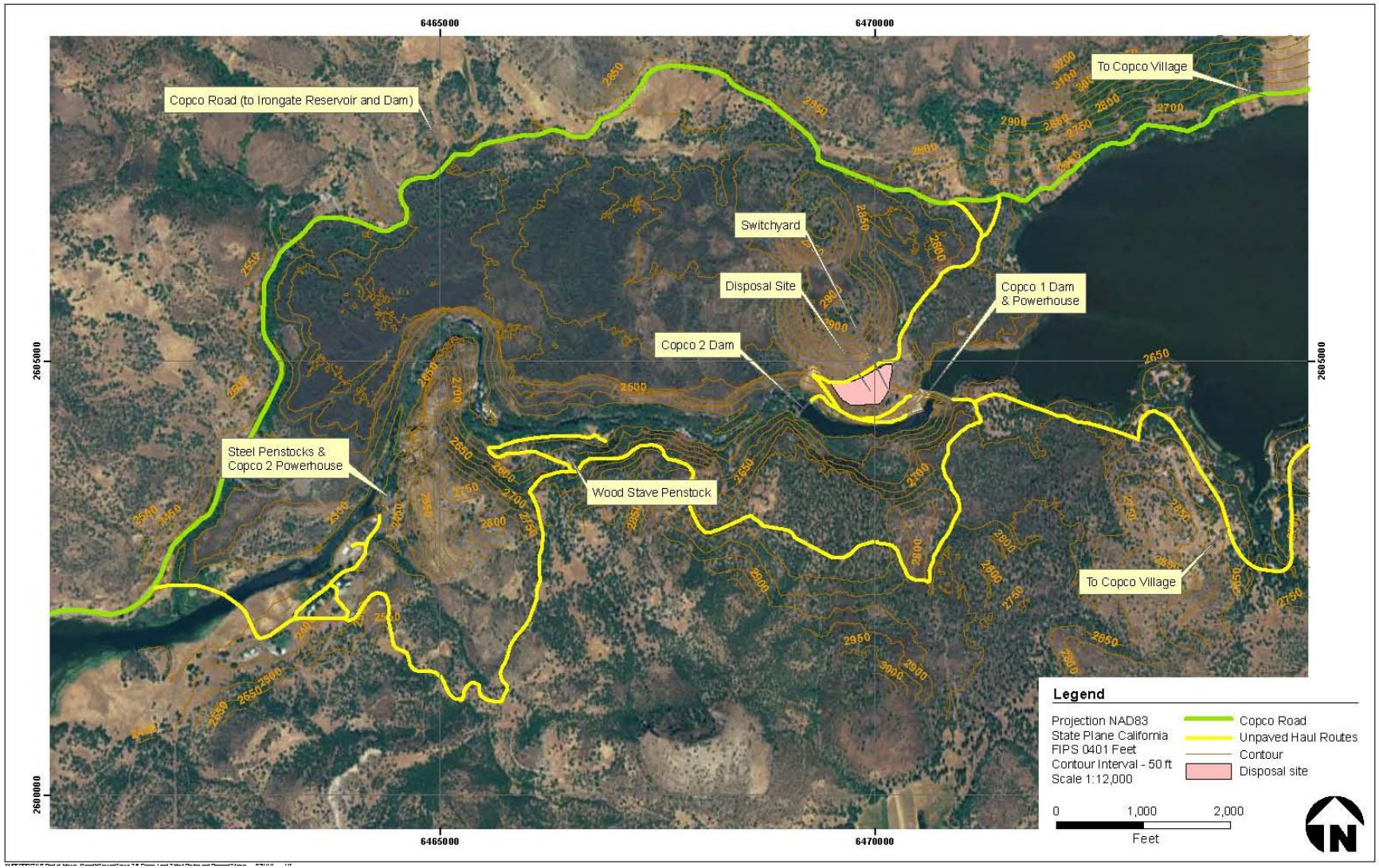


Figure 2-10. Copco 1 and Copco 2 Haul Roads and Disposal Sites

Estimated waste quantities for full removal of Iron Gate Dam and powerhouse include 12,000 yd^3 of concrete, 1.1 million yd^3 of earthfill, and 1,000 tons of mechanical and electrical items at the dam and powerhouse. Removal would also generate waste from four buildings with a combined area of 2,300 square feet.

An original borrow site approximately 0.75 miles upstream from the dam on the left abutment would serve as a disposal site for earth and concrete waste (see Figure 2-11). Another disposal site would be the existing concrete-lined side-channel spillway, chute, and terminal structure, which could accept up to 300,000 yd^3 of excavated material. As the excavation descended, the DRE would need to construct ramps out of the canyon. The DRE would stockpile some rockfill for later use as slope protection for the upstream cofferdam. The DRE would dispose of reinforcing steel, concrete, and mechanical and electrical equipment in the same manner as for the Copco 1 and Copco 2 sites.

Existing haul roads would require improvements to handle two-way traffic of large construction equipment between the dam and the disposal site. The access bridge across the Klamath River downstream of the dam could also require improvements to handle the construction equipment loads.

DOI modeling studies indicate that this drawdown would flush 25 to 38 percent of the trapped sediments in the reservoir (primarily silts and clays). Once eroded from the reservoir, the fine sediment would continue in suspension all the way to the ocean. The remaining sediments would consolidate after drawdown, and restoration efforts would stabilize the remaining sediment.

The City of Yreka's water supply pipeline passes under the upstream end of the Iron Gate Reservoir and would become exposed to high-velocity river flows after dam removal. Reconstructing the pipe further under ground would likely require digging in bedrock, which would be complicated and expensive. Therefore, the DRE would construct a new, elevated pipeline and steel pipeline bridge to support the pipe above the river. The prefabricated steel pipe bridge would be wide enough to accommodate the pipeline and walkway on the deck. The pipeline bridge would likely be three spans with a center span of 200 feet and two end spans of 100 feet. The spans would be supported on concrete piers. The new pipeline would be connected to the existing buried pipeline at each end of the bridge. In order to avoid a disruption to the City's water supply, the permissible outage period would be limited by the available storage tank capacity.

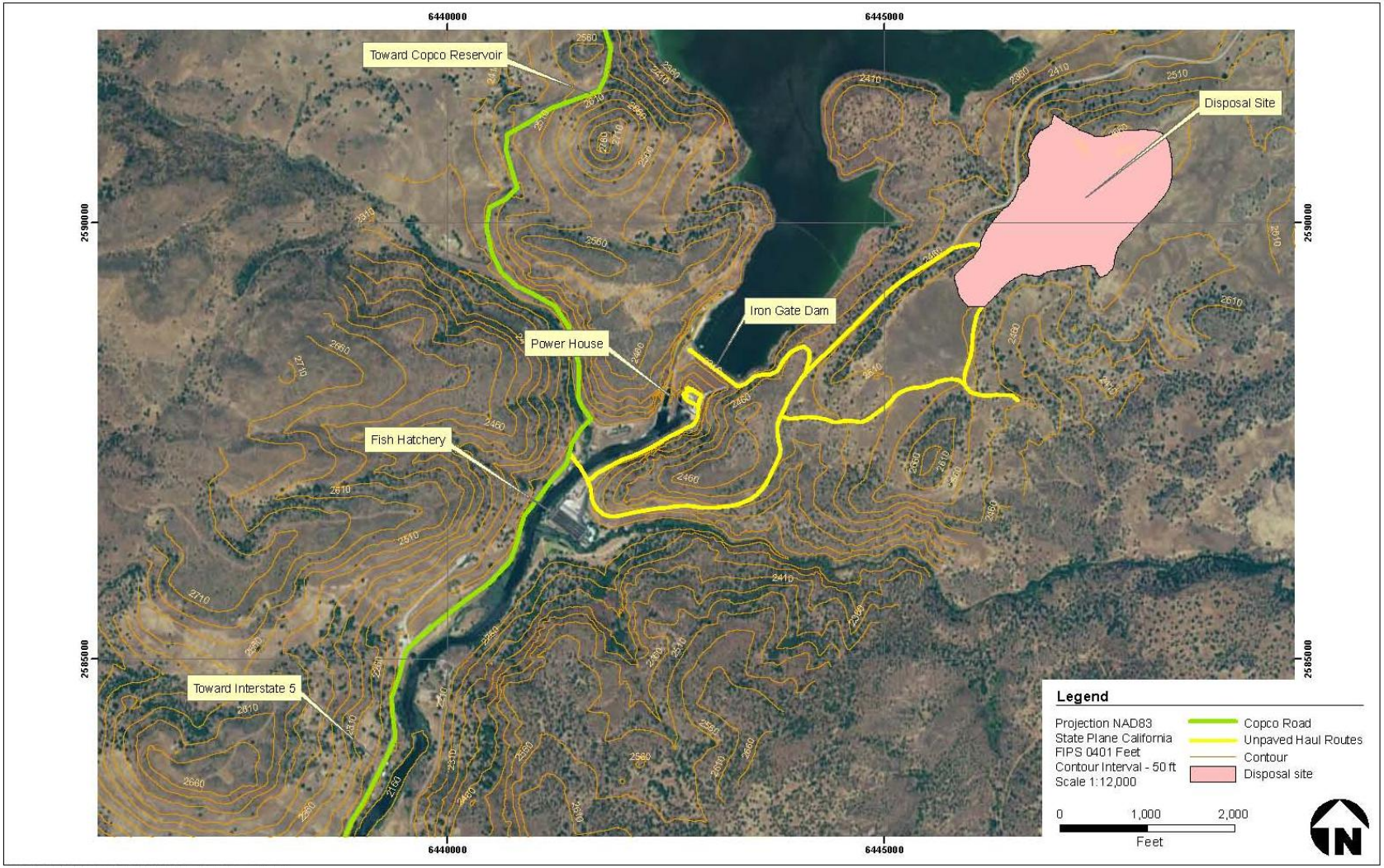


Figure 2-11. Iron Gate Haul Roads and Disposal Sites

2.4.3.2 Schedule

The DRE would begin preparatory work in May 2019. The initial schedule for this alternative would stop power generation at the Iron Gate and J.C. Boyle facilities on December 31, 2019. Power generation would stop at Copco 2 Powerhouse in April 2020 and would cease at Copco 1 in October 2019. Table 2-11 shows the schedule to draw down J.C. Boyle, Copco 1, and Iron Gate Reservoirs. (Copco 2 has no drawdown limitations or sediment stored in the reservoir.) The Lead Agencies designed drawdown rates to protect slope stability, public safety, and structures near the reservoirs. The drawdown periods were scheduled to avoid sediment release into downstream areas during critical times for sensitive aquatic species. The end dates in Table 2-9 may vary depending on year type; these dates reflect an average water year, but the draw down might be longer in wet years or shorter in dry years.

Table 2-11. Drawdown Plans for J.C. Boyle, Copco 1, and Iron Gate Reservoirs

	J.C. Boyle	Copco 1			Copco 2	Iron Gate
		Phase 1	Phase 2	Phase 3		
Start Date	1/1/2020	11/1/2019	1/1/2020	2/5/2020	6/1/2020	1/1/2020
Starting Elevation (feet)	3,793	2,606	2,590	2,529	2,484	2,328
End Date	2/1/2020	11/17/2019	2/4/2020	2/24/2020	6/30/2020	2/11/2020
Ending Elevation (feet)	3,762	2,590	2,529	2,484	2,460	2,202
Average Drawdown (feet/day)	1	1	1.75	2.25	0.8	3

Figure 2-12 provides a schedule for the Proposed Action based on construction requirements for removal.

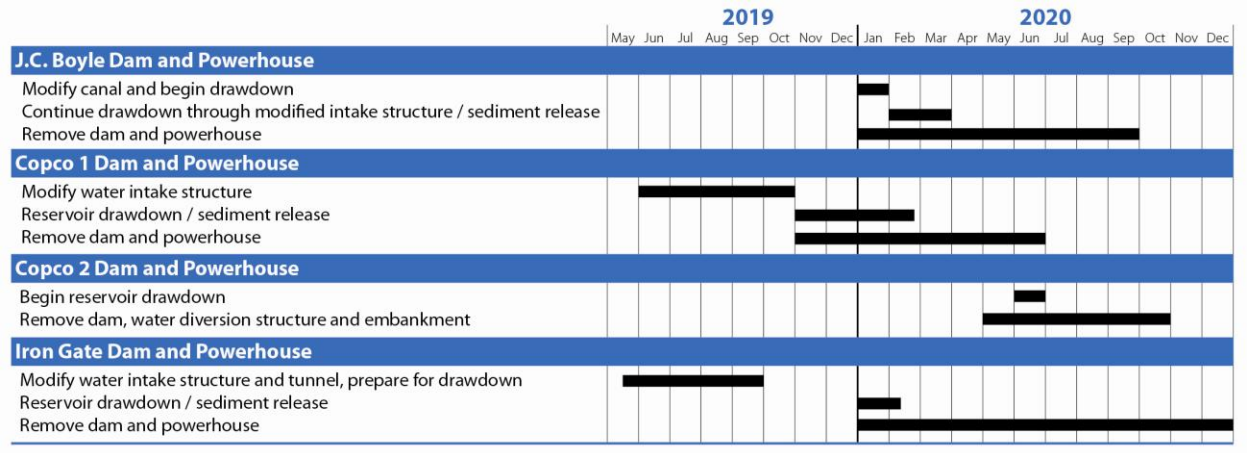


Figure 2-12. Anticipated Schedule for Full Facilities Removal

2.4.3.3 Workforce

The size of the construction workforce at each site would vary, and the peak times for construction would be staggered. Table 2-12 shows the construction workforce needed for the Proposed Action.

Table 2-12. Workforce Projections for the Proposed Action

Facility	Estimated Average Construction Workforce	Duration	Estimated Peak Workforce	Peak Period
J.C. Boyle	25 to 30 people	10 months	40 - 45	Jul 2020 - Sep 2020
Copco 1	30 to 35 people	12 months	50 - 55	Nov 2019 - Apr 2020
Copco 2	25 to 30 people	7 months	35 - 40	May 2020 - Aug 2020
Iron Gate	35 to 40 people	18 months	75 - 80	Jun 2020 - Sep 2020

2.4.3.4 Environmental Measures

The Lead Agencies have several standard procedures and management practices that they incorporate into projects to avoid adverse effects to the environment. Key elements of these measures are summarized below, and a more complete description is presented in Appendix B. All the procedures and practices identified in this EIS/EIR are incorporated into each action alternative analyzed in this EIS/EIR.

Best Management Practices

For all deconstruction and/or construction activities, the DRE would implement standard pollution prevention measures as part of project design specifications and standard construction practices. These measures would include the following:

(1) Storm water erosion and sediment control measures for all deconstruction and/or construction activities;

(2) Proper control of non-stormwater discharges;

(3) Water application to exposed soil surfaces at least three times per day when needed for dust abatement; and

(4) Hazardous spill prevention and response measures.

The Proposed Action would include the transfer of PacifiCorp land surrounding the Four Facilities (Parcel B lands) to a state agency. This agency would install fencing around these lands for the purposes of land management. It would prevent cattle access but would allow wildlife to pass.

Terrestrial Resource Avoidance

The DRE would take actions to avoid impacts that could include fencing wetlands, training employees about species present, excluding workers and construction activities on areas with sensitive species, and filling trenches and holes quickly to avoid trapping wildlife. Measures would be implemented during construction to avoid or reduce impacts to special-status birds and migratory birds in compliance with the Endangered Species Act, Bald and Golden Eagle Protection Act, and the Migratory Bird Treaty Act. Specific avoidance measures would be developed in consultation with California Department of Fish and Game, Oregon Department of Fish and Wildlife (ODFW), and USFWS.

Repair Road Damage
The DRE would repair any construction-related damage to surrounding roads.

Health and Safety Plan
The DRE would prepare and implement a worker Health and Safety Plan prior to the start of construction activities.

Hazardous Materials Disposal
If hazardous materials are encountered during construction or deconstruction activities, the DRE would use protocols for proper handling, transport, and disposal of the materials.

Traffic Signs
The DRE would install signs to route construction traffic and warn other motorists about construction activities.

Work Area Isolation for Dam Removal
The DRE would need to control water and isolate the work area from flowing water and aquatic organisms throughout the duration of construction. The DRE could control water in most areas using gravity diversions; however, pumps could be required to dewater isolated ponding. Pumps would be screened to prevent entrainment of fish. Prior to pumping, the DRE would conduct a fish rescue, as described below, within the screened area isolating the pump.

The DRE would work in wet conditions in areas that cannot be dried. For in-water work, physical barriers would isolate the work area. Barriers would consist of bulk bags, which are fabric bags filled with sand or gravel that can be stacked as "bricks" to temporarily isolate work areas. Alternately, the DRE could use steel sheets, concrete blocks, gravel berms, inflatable berms or plastic sheeting as physical barriers to isolate work areas. All barriers would be temporary, and would be removed after completing work.

A fish rescue would be conducted in all areas that cannot be drained in a manner that allows fish to volitionally depart the area. Fish rescue activities would follow each states' regulations, rules, and policies and would be in accordance with the NOAA Fisheries Service and USFWS biological opinions on the Proposed Action.

2.4.3.5 Reservoir Restoration
Under the Proposed Action, there would be substantial erosion of the reservoir sediment while the reservoirs were being drawn down. The eroded sediment would then be transported downstream. Following drawdown of the reservoirs, the DRE would complete restoration actions including revegetation, recreation area maintenance, and recreation area decommissioning, described in this section.

Following drawdown of the reservoirs, revegetation efforts would be initiated to support establishment of native wetland and riparian species on newly exposed reservoir sediment. Access for ground application equipment is expected to be limited immediately following drawdown due to terrain, slope, and sediment instability. Upper areas would be reseeded from a barge until the reservoir levels become too low to operate and access the barge. As the reservoirs are drawn down trucks will be used to apply hydroseed to all accessible areas. Aerial application

would be necessary for precision applications of material near the sensitive areas and the newly established river channel, as well as in the remaining areas inaccessible by barge or truck.

Additional fall seeding might be necessary to supplement areas where spring hydroseeding was unsuccessful. In cases where mulch moved/degraded or otherwise exposed bare soil, aerial hydroseeding would be used again for the fall re-seeding. In other cases, where establishment failed, yet the mulch remained intact, new seed material applications might need to be incorporated in order to re-establish seed/soil contact sufficient for germination.

J.C. Boyle

Sediment in J.C. Boyle Reservoir is concentrated in the historical active channel and most of the sediment is near the dam. During drawdown, most of the sediment near the dam would be eroded from the reservoir area given the steep slopes on the reservoir floor. After drawdown, there would be minor amounts of sediment consolidation on the floodplain areas. Herbaceous species would be planted or would naturally recruit in the spring following drawdown. Woody species would gradually establish on the river terraces as they propagated from the outer edges of the reservoir.

Copco 1

Among the reservoirs that would be removed, Copco 1 Reservoir contains the majority of the sediment and is the widest of the reservoirs. Most of the erosion would be focused in the main channel of the Reservoir where the thickness of the remaining sediment would be the greatest. Significant alluvial surface (the benches) would be exposed with drawdown of Copco 1. However, it is possible that reservoir sediment would remain in some of the side channels, particularly if dam removal occurred in a dry year.

After drawdown, the remaining sediments would begin to consolidate and decrease in thickness. Sediment erosion analysis indicates that allowing one high flow event (greater than 7,000 cfs) to pass through the reservoir area would minimize the need for sediment excavation after reservoir drawdown as part of the restoration effort. The erosion processes would be expected to occur during the winter season during the drawdown effort when the sediment would be the most erodible. Reestablishment of herbaceous species would occur soon after the revegetation in the spring. Woody species would be planted along the river banks and would establish over a period of years.

Iron Gate

The reservoir sediment at Iron Gate Reservoir is relatively thin and the only thicknesses over 5 ft were found in the Jenny Creek delta. The river corridor is relatively narrow throughout the Iron Gate reach and the side slopes of the reservoir area are mostly steeper than 20 percent, with a substantial area steeper than 40 percent. Most of the sediment remaining after dam removal would be less than 3 feet thick.

There are far fewer alluvial surfaces in Iron Gate Reservoir than there are in Copco 1 Reservoir, and the resulting riparian corridor would be much narrower at Iron Gate Reservoir than at Copco 1 Reservoir. The tributaries are heavily vegetated with woody species upstream of Iron Gate Reservoir (Philip Williams & Associates 2009) and the tributaries are expected to reestablish a similar riparian and geomorphic condition in the exposed reservoir areas.

2.4.3.6 Recreation Facilities

The Proposed Action would change recreational opportunities from lake-based recreation to river-based recreation. Table 2-13 shows the change to existing facilities under the Proposed Action.

Table 2-13. Recreation Facilities under the Proposed Action

Site Name	Existing Facilities	Facilities Following Dam Removal
Sites at J.C. Boyle Reservoir (Oregon)		
Pioneer Park	Two day-use areas with picnic tables, fire rings, and portable toilets	All facilities would be removed
Topsy Campground	Campground, day-use area, boat launch	Site would be converted to river access facility. Boat ramp would either be extended to the river channel or removed. Other facilities would remain.
Sites at Copco 1 Reservoir (California)		
Mallard Cove	Day-use picnic area and boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted.
Copco Cove	Picnic area and boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted.
Sites at Iron Gate Reservoir (California)		
Fall Creek Trail	Day-use area and trail	This site would remain. There would be no improvements or changes.
Jenny Creek	Day-use area and campground	This site would remain. There would be no improvements or changes.
Wanaka Springs	Day-use area, campground, boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Camp Creek	Day-use area, campground, boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Juniper Point	Primitive campground and boat dock	All facilities would be removed. Parking area would be regraded, seeded, and planted
Mirror Cove	Campground and boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Overlook Point	Day-use area	All facilities would be removed. Parking area would be regraded, seeded, and planted
Long Gulch	Picnic area and boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Dutch Creek	Day-use area	All facilities would be removed. Parking area would be regraded, seeded, and planted
Iron Gate Fish Hatchery Public use Area	Day-use area and boat launch	This site would remain. There would be no improvements or changes.

Source: O'Meara et al 2010

2.4.3.7 Keno Transfer

As a connected action to removal of the Four Facilities, PacifiCorp would transfer ownership and operational responsibility of the Keno facility to the DOI. Reclamation is working with PacifiCorp on an Agreement in Principal for the transfer. They have a draft agreement, which will be further developed in preparation for a possible Affirmative Determination.

Prior to the transfer, PacifiCorp would complete any necessary improvements to the facility in order to meet DOI Directives and Standards for dam safety. Prior to the transfer, the facility would be operated under the terms of the existing contract signed in 1968 between PacifiCorp and Reclamation. Following the transfer, DOI would continue to operate the facility consistent with the terms of the same contract and with historic practices (KHSA Sections 7.5.3 & 7.5.4). Thus, operations under DOI would be consistent with the historic operations of the facility in place since the existing contract was signed on January 4, 1968; therefore, there would be no changes to operations or the surrounding areas as a result of the transfer. Future upgrades at the Keno facility by DOI would be subject to additional NEPA compliance.

2.4.3.8 East Side/West Side Facility Decommissioning – Programmatic Measure

In the event of an affirmative Secretarial Determination, under a plan outlined in the KHSA, PacifiCorp would apply to FERC for a partial surrender of its license of the East and West Side facilities in order to decommission the generating facilities (KHSA section 6.4.1(A)). PacifiCorp would be responsible for the decommissioning and for recovering its costs through "standard ratemaking procedures" (KHSA 6.4.1(B)). Once the decommissioning was completed, the lands associated with the East and West Side facilities would be transferred to DOI.

The two facilities were proposed for decommissioning in PacifiCorp's 2004 relicensing application. Removing the two facilities would result in the loss of 3.8 megawatts (MW) of generating capacity and the removal of the generating infrastructure. The dams and associated infrastructure were built in 1921, and would require upgrading and maintenance to remain in compliance with DOI and FERC standards. The Link River Dam, which is the point of diversion for the two generating facilities, is already owned by Reclamation.

2.4.3.9 KBRA – Programmatic Measures

As described in Chapter 1, the KBRA is connected to the KHSA. The KBRA is also a basin-wide approach to addressing the current resources challenges. The KBRA will be signed by the United States upon congressional authorization.[3] The complete KBRA package entails various commitments and actions that have been or will be proposed and/or undertaken in the basin by federal, state, local, tribal, and private interests. Some of the KBRA actions could have effects (whether adverse or beneficial) on the same environmental resources that would be affected by dam removal. Some KBRA actions are expressly preconditioned by and therefore hinge upon dam removal, and an affirmative Secretarial Determination. Some KBRA actions are federal but are not expressly linked to dam removal, and some actions are completely between private parties.

[3] Under the KHSA and KBRA (Agreements) the United States will be a party to the KBRA at the time of a Secretarial determination under the KHSA, and obligated to implement the KBRA according to its terms.

NEPA Specific Analysis

The federal lead agency, the DOI, is analyzing the KBRA as a connected action. NEPA defines connected actions as those actions that are closely related or cannot or will not proceed unless other actions are taken previously or simultaneously (40 CFR 1508.25(a)(1)(ii)).[4] Some actions or component elements of the KBRA are independent obligations and thus have independent utility from the KHSA, but the implementation of several significant elements of the KBRA package would be different, if the determination under the KHSA is not to pursue full dam removal. Recognizing that implementation of many elements of the KBRA are unknown and not reasonably foreseeable at this time, the connected action analysis is being undertaken at a programmatic level. Consequently, appropriate NEPA compliance will be completed for the KBRA in the future.

For purposes of this analysis, the KBRA is viewed as a whole program even though some of its component parts are currently being implemented (those without a federal nexus or not subject to environmental review) or could be implemented on an individual basis without dam removal. One of the reasons the KBRA is treated as a whole for purposes of this analysis under NEPA is that the individual activities under the KBRA will be implemented, through adaptive management and in close coordination with committees comprised of stakeholders, in a manner that seeks to attain synergy and optimize benefits through a coordinated, holistic approach to restoration and water management. Implementing those KBRA activities that are not connected to facilities removal on an individual basis without the benefit of adaptive management and stakeholder input will likely not provide the same level of optimization.

Consequently, for purposes of NEPA, in the EIS for alternatives where dams are not removed, the KBRA, as currently signed by the parties, would not be implemented. This is not a judgment about whether any particular measure in the KBRA will be implemented in the absence of dam removal. Rather, it is an assumption that in the absence of dam removal, the KBRA will not include all of the components present in their current form. This means that this document does not make decisions about implementing any specific program, plan, commitment, or activity under the KBRA if dams are not removed. Federal decisions on specific measures in the KBRA, including any necessary additional environmental review, will be made in a separate process. This document will be used to make a decision related only to dam removal but in doing so, NEPA requires we properly scope the alternative and impacts analysis.

CEQA Specific Analysis

For purposes of CEQA, relevant parts of the KBRA analysis are programmatic, as described in Section 15168 of the CEQA Guidelines. This decision was made because many of its component elements have not been specified to a degree where the associated impacts would be reasonably foreseeable for purposes of this environmental analysis. The parties recognize that future project-specific analysis may be required for various components of the KBRA as they become more clearly defined and if an affirmative public approval is identified. A program-level document is

[4] We acknowledge, however, that the KBRA could also be analyzed as a cumulative or similar action under 40 CFR 1508.25(a)(2) and (3). We note that all three definitions (connected action, cumulative actions, and similar actions) are within the section that provides parameters for the "scope" of the action, which determines both the range of alternatives and the impacts to be considered in an EIS. Ultimately, however, we believe the important point is not the labeling but the analysis and whether the decision (in this case whether to remove four dams) is informed by a EIS that is proper in scope.

appropriate when a project consists of a series of smaller projects or phases that may be implemented separately. Under the programmatic EIR approach, future projects or phases may require additional, project-specific environmental analysis. It should also be noted that this EIR makes certain assumptions about the foreseeable effects of KBRA based on existing information, including, among other things, how the fishery and water resources programs may be designed and implemented. The lead agency understands that subsequent analysis during permitting of dam removal may be required by any public entity in California with an approval or permitting obligation if the circumstances specified by CEQA Guidelines section 15162(a) are triggered.

Importantly, California could have analyzed the associated impacts of the KBRA relative to the KHSA in the indirect and cumulative impacts analysis portion of the KHSA EIR as it is not affirmatively approving or carrying out any one aspect of the KBRA that would be subject to environmental review. California recognizes it is not "approving" any discretionary portion of the KBRA that could alter the physical environment and that by signing the KBRA it has already executed and committed to the agreement itself. Thus, similarly to the EIS, there are no alternatives that consider what a new or revised KBRA might look like in the event dams are not removed. Rather, to avoid confusion, duplication, and wasted resources, California has determined that the concurrent and connected nature of the KBRA to the KHSA warrants a clear understanding of its potentially significant impacts and that the approach of programmatic analysis is equally, if not more, sufficient for providing that information to decision-makers.

Thus, out of an abundance of caution, and to ensure full transparency, California has agreed to consider significance determinations for those portions of the KBRA elements located within California consistent with CEQA Guideline section 21080(b)(14) of the Public Resources Code, and CEQA Guidelines Section 15277 in a programmatic fashion. However, it too considers the proposed actions by California to be implementation of the KHSA and thus has crafted alternatives only for dam removal itself, assuming that absent full facilities removal the relevant elements of the KBRA will no longer be ascertainable. The lead agency recognizes that in the event subsequent analysis is deemed appropriate, it will be required to consider any feasible alternatives, mitigation measures, and any other elements required by CEQA as the basis for any approval of such KBRA project or phase in accordance with existing law.

Implementation

Non-federal parties who have signed the KBRA include states, tribes, counties, irrigators, and other organizations (Table 2-14). Prior to the enactment of federal authorizing legislation, federal agencies are not parties to the KBRA. However, DOI, NOAA Fisheries Service, and the United States Department of Agriculture have each expressed their intent to take actions consistent with the KBRA to the extent that such actions are consistent with the agency's existing legal authorities and appropriations available for such purposes. These federal agencies have each sent separate letters to the non-federal parties expressing this intent.

Upon the enactment of authorizing legislation, NOAA Fisheries Service, United States Forest Service (USFS), Bureau of Indian Affairs, Bureau of Land Management, Reclamation, and the USFWS would become parties to the KBRA. Additional appropriations would likely be necessary for these agencies to fully implement their responsibilities under the agreement.

Table 2-14. Non-Federal Parties to the KBRA

Karuk Tribe	Malin Irrigation District
Klamath Tribes	Midland District Improvement Company
Yurok Tribe	Pioneer District Improvement Company
California Department of Fish and Game	Plevna District Improvement Company
California Natural Resources Agency	Reames Golf and Country Club
Oregon Department of Environmental Quality	Shasta View Irrigation District
Oregon Department of Fish and Wildlife	Sunnyside Irrigation District
Oregon Water Resources Department	Tulelake Irrigation District
Humboldt County, California	Van Brimmer Ditch Company
Klamath County, Oregon	Randolph and Jane Walthall 1995 Trust
Ady District Improvement Company	Westside Improvement District #4
Collins Products, LLC	Winema Hunting Lodge, Inc.
Enterprise Irrigation District	Upper Klamath Water Users Association
Don Johnston & Son	American Rivers
Inter-County Properties Company	California Trout
Klamath Irrigation District	Institute for Fisheries Resources
Klamath Drainage District	Northern California/Nevada Council Federation of Fly Fishers
Klamath Basin Improvement District	Pacific Coast Federation of Fisherman's Associations
Klamath Water Users Association	Salmon River Restoration Council
Klamath Water and Power Agency	Trout Unlimited
Bradley S. Luscombe	

The "interim period" is the time between the signing of the KBRA and full implementation of the limits on water diversions to Reclamation's Klamath Project. The events that must occur to allow the full implementation of water diversion limits include the removal of the Four Facilities under the KHSA as well as other conditions listed in KBRA Sections 15.3.4 and 15.3.1.A.

While the water diversions to Reclamation's Klamath Project users are not enforceable during the interim period, water diversions would conform to the limits described below in the Diversion Limitations section as closely as possible. Until the On-Project Plan is fully implemented, it might not be possible for water to be managed consistent with the diversion limitations in all years because there are an insufficient number and amount of water measuring devices and control structures.

Programs or activities that are scheduled to occur prior to the enactment of authorizing legislation would be conducted under existing authorities (see on-going activities in Table 2-15). However, implementation of most interim period activities would be dependent on appropriate authorizing legislation through Congress.

Table 2-15. Summary of KBRA Programs

Program[1]	On-Going Activities	Increased in Magnitude or Accelerated Schedule with KBRA	New Program initiated by KBRA
Fisheries Programs:			
Fish Habitat Restoration Activities [2]	X	X	
Fisheries Restoration Phase I Plan		X	X
Fisheries Restoration Phase II Plan			X
Fisheries Reintroduction Plan – Phase I, Oregon			X
Fisheries Reintroduction Plan – Phase II, Oregon			X
Fisheries Reintroduction Plan – California			X
Fisheries Monitoring Plan		X	
Additional Water Storage Projects:			
Williamson River Delta Project	X [3]	X	
Agency Lake and Barnes Ranches Project	X [3]	X	
Wood River Wetland Restoration Project			X
Future storage opportunities			X [4]
Water and Power Programs:			
Water Diversion Allocations for Reclamation's Klamath Project and National Wildlife Refuges (NWR)			X [5]
Groundwater Technical Investigations			X
On-Project Plan			X
Winter Shortage Plan			X
Water Use Retirement Program (WURP)			X
Off-Project Water Settlement (OPWAS)			X
Off-Project Reliance Program			X
Power for Water Management Program			X
Drought Plan			X
Emergency Response Plan			X
Climate Change Assessment	X [3]	X	
Environmental Water Management			X
Interim Flow and Lake Level Program			X
Regulatory Assurances Programs:			
Fish Entrainment Reduction			X
General Conservation Plan or Habitat Conservation Plan			X
County and Tribal Programs:			
Klamath County Economic Development Plan			X
California Water Bond Legislation (Siskiyou County Economic Development Funding)			X
Tribal Programs Fisheries and Conservation Management			X
Tribal Programs Economic Revitalization			X
Mazama Forest Project			X
Klamath Tribes Interim Fishing Site			X

Notes
1. "Plans" include both the development of the plan and the implementation of the plan.
2. While on-going fish habitat restoration activities are not part of the Proposed Action because they are conducted under current authorities and funding levels, the scope of these activities would be increased in magnitude and accelerated through implementation of the KBRA. Habitat restoration under the Proposed Action would be guided by the Fisheries Restoration Plan to be developed under the KBRA.
3. Action is considered part of the No Action/No Project Alternative
4. Development of additional storage would occur with implementation of KBRA and associated funding.
5. During the Interim Period, water diversion limitations to Reclamation's Klamath Project users would conform to the limits described in the Diversion Limitations section as closely as possible. However, before full implementation of the On-Project Plan, it might not be possible to fully comply with the diversion limitations in all years.

With enactment of authorizing legislation there would be the potential for additional funding to enhance some of the ongoing programs. In Table 2-15, these are shown as programs that would be increased in magnitude or would be accelerated in schedule with implementation of the KBRA in Table 2-15. Most of the programs described in the KBRA would only occur with the enactment of federal authorizing legislation and approval of funding at both the federal and state levels.

The plans and programs described in the KBRA lead through a series of milestones that culminate in the formal relinquishment of claims for damages, permanent assurances related to tribal water rights, and limitations on water diversions to Reclamation's Klamath Project. Long-term implementation would occur after the full implementation of the water diversion limitations.

The KBRA does not supersede existing federal laws such as NEPA and ESA. Programs to be developed and implemented under the KBRA would still be subject to review and analysis and would need to comply with federal statutory authorities.

The programs proposed by the KBRA and shown in Table 2-15 are considered to be connected to the Proposed Action (except as noted). This list includes plans and programs that would only be implemented through enactment of authorizing legislation and ongoing programs that would be enhanced by additional funding resulting from authorizing legislation. The portion of ongoing actions that would be amplified following enactment of authorizing legislation are considered a part of the Proposed Action and the portion that would be implemented regardless is considered under the No Action/No Project Alternative as noted above in Section 2.3.2.

Fisheries Program

The Fisheries Program of the KBRA has three main goals:

A. Restore and maintain ecological functionality and connectivity to historic habitat.
B. Re-establish and maintain naturally sustainable and viable populations of fish to the full capacity of the restored habitats.
C. Provide for full participation in harvest opportunities.

To meet these goals, the parties to the KBRA agreed to prepare and implement fisheries restoration, reintroduction and monitoring plans and to provide additional sources of instream water to support fish.

Fisheries Restoration Plans

The Phase I Fisheries Restoration Plan is intended to establish restoration priorities and criteria for restoration project selection for the immediate future through 2020 (KBRA Section 10.1). The plan is to be prepared by basin Fish Managers who are defined in the KBRA as federal, state, or tribal agencies that have responsibility under applicable laws to manage one or more fish species or their habitat in the Klamath Basin. USFWS and NOAA Fisheries Service are to be the co-leads for administrative tasks related to the preparation of both the Phase I and Phase II Restoration Plans. Under the schedule anticipated in the KBRA, the Phase I Plan would be completed in March 2012.

The effectiveness of Phase I restoration activities would be monitored under the Fisheries Monitoring Plan. Monitoring results would be used in the development of the Phase II Restoration Plan to adjust the recommended mix of restoration activities, priorities, and/or project locations to more effectively restore aquatic habitats. The Phase II Fisheries Restoration Plan would establish long-term restoration priorities and an adaptive management process to maintain fish restoration through 2060. The Draft Phase II Restoration Plan is to be prepared within 7 years of the finalization of the Phase I plan, and a final plan is to be completed by March 31, 2022 (KBRA Section 10.2).

Implementation of the Phase I plan could include actions for restoration of existing fisheries in the upper basin, as well as actions necessary to prepare for reintroduction of anadromous fish upstream of Iron Gate Dam. Specific elements could include restoration and protection of riparian vegetation, water quality improvements, restoration of stream channel functions, measures to prevent excessive sediment inputs, remediation of fish passage blockages, and prevention of entrainment into diversions (KBRA Section 10.1.2). See Table 2-16 for a geographic breakdown of when and where restoration activities would occur.

Restoration activities similar to the general classes of actions described in the KBRA currently occur throughout the basin as funding is available. It is also expected that the Phase I Restoration Plan would build upon existing activities and identified restoration needs and that implementation would include the same types of restoration activities that are currently conducted within the basin. Activities would be prioritized under the Plan and additional funding that may become available under the KBRA would allow greater improvements to be realized than would occur without the KBRA.

Restoration activities are being conducted downstream of Iron Gate Dam on the mainstem and tributaries as well as in the upper basin subject to funding availability. The same types of activities would be expected to be conducted under the KBRA fish restoration program and would include the following types of work:

- Floodplain rehabilitation work includes activities to improve or restore connections between channels and floodplains to create and maintain off-channel habitat accessible to overwintering juvenile salmonids. Floodplain rehabilitation could include activities such as riparian planting and understory thinning, to facilitate the development of mature riparian stands that would provide shading and large and small wood to stream channels and floodplains; wetland restoration; and levee setback or dike removal to reconnect floodplain hydrology.
- Large woody debris placement could include both mobile wood and complex structures and could be used to create off-channel habitat or provide cover in pools.
- Correction of fish passage issues could include culvert upgrades or replacement to meet current fish passage standards and correction of other fish blockages to provide access to new or historic habitats.

Table 2-16. KBRA Fisheries Restoration Projects

KBRA Project	Anticipated Schedule
Preparation Phase I Restoration Plan	2012–2013
Preparation Phase II Restoration Plan	2018–2019
Williamson River Aquatic Habitat Restoration	2012–2021
Sprague River Aquatic Habitat Restoration	2012–2021
Wood River Aquatic Habitat Restoration	2012–2021
Williamson Sprague Wood Screening Diversion	2012–2014
Williamson and Sprague USFS Uplands	2012–2021
Upper Klamath Lake Aquatic Habitat Restoration	2012–2021
Screening of Upper Klamath Lake Pumps	2012–2014
Upper Klamath Lake Watershed USFS Uplands	2013–2016
Keno Reservoir Water Quantity Studies and Remediation Actions	2012–2021
Keno Reservoir Wetlands Restoration	2013–2017
Keno to Iron Gate Upland Private and Bureau of Land Management	2012–2021
Keno to Iron Gate Upland USFS (Goosenest)	2012–2021
Keno to Iron Gate Mainstem Restoration	2012–2021
Keno to Iron Gate Tributaries – Diversions and Riparian	2016–2018
Shasta River Aquatic Habitat Restoration	2012–2021
Shasta River USFS Uplands	2012–2021
Scott River Aquatic Habitat Restoration	2012–2021
Scott River USFS Uplands	2012–2021
Scott River Private Uplands	2013–2019
Mid-Klamath River and Tributaries (Iron Gate to Weitchpec) Aquatic Habitat Restoration	2012–2021
Mid-Klamath Tributaries USFS Upland	2012–2021
Mid-Klamath Tributaries Private Upland	2012–2021
Lower Klamath River and Tributaries (Weitchpec to Mouth) Aquatic Habitat Restoration	2012–2021
Lower Klamath Private Uplands	2012–2021
Salmon River Aquatic Habitat Restoration	2013–2018
Salmon River USFS Upland	2012–2021

Source: KBRA Appendix C-2
Key:
USFS: United States Forest Service

- Cattle exclusion typically includes the construction of fencing to prevent cattle from trampling stream banks, which allows riparian vegetation to grow. Cattle exclusion is often conducted in conjunction with riparian planting. Cattle exclusion fencing would only be implemented in accordance with applicable federal, state and county regulation and guidance.
- Mechanical thinning and prescribed burning are used to mimic some of the functions and characteristics historically provided by a natural fire regime. Thinning and prescribed burning reduce the potential for more catastrophic fires and the erosion that often follows.
- Purchases of conservation easements and land from willing sellers allow for more direct land management for habitat enhancement purposes.
- Decommissioning of roads could reduce road densities in areas with a high potential for failure and could stabilize slopes. Road failures can be a major source of chronic sediment inputs into stream systems.
- Gravel augmentation involves the direct placement of spawning-size gravel into the stream channel. Gravel augmentation could increase spawning habitat in systems by increasing the amount of area with suitable substrate. Currently, suitable spawning gravel substrate is limited due to capture of gravels behind dams or armoring of channel banks, or it could be covered with fines from sedimentation.
- Treatment of fine sediment sources could include a broad array of actions including management of stormwater runoff from roads and other developed areas, agricultural and forestry management practices, and other specific actions depending on the sources of fine sediments.
- Screening of diversion structures on the Williamson, Sprague and Wood Rivers and Upper Klamath Lake (UKL) pumps. (This activity is separate from the fish entrainment reduction activities proposed on Reclamation's Klamath Project facilities as described under the Regulatory Assurances Program.)
- Above UKL, activities may include restoration easements and grassbanks that facilitate habitat improvement and landowner economic stability.

Fisheries Reintroduction Plans

Under the KBRA, the states of California and Oregon would each prepare separate Fisheries Reintroduction plans that identify the facilities and actions that would be necessary to start reintroduction of anadromous fish upstream of Iron Gate Dam (KBRA Section 11). The Phase I reintroduction plans would be prepared if there is an Affirmative Determination and each state concurs with that Determination. Reintroduction activities specifically exclude the Trinity River watershed upstream of the confluence with the Klamath River; Lost River and its tributaries; and Tule Lake basin.

The Oregon Phase I Reintroduction Plan, to be prepared by the ODFW and the Klamath Tribes, would identify the facilities and actions necessary to start reintroduction and would be adaptable in order to incorporate information gained from the monitoring program. ODFW, the Klamath Tribes, and other Fish Managers would be responsible for implementation of the Phase I Reintroduction Plan.

Phase I reintroduction upstream of Upper Klamath Lake may include active intervention and movement of fish into suitable habitats (KBRA Section 11.3). This could include facilities for

collection, transport, and acclimation of fish. Fish would be collected and transported over the Four Facilities prior to dam removal, and trap and haul operations would occur at Keno Dam until water quality conditions no longer required them. A variety of release and rearing strategies would be utilized to optimize success; however, the KBRA does not contain specifics on what those strategies might include.

The California Phase I Reintroduction Plan, to be developed by the California Department of Fish and Game, would adopt a passive approach including development of reintroduction goals, monitoring protocols, habitat assessments, and strategies for adapting the plan as additional information is developed (KBRA Section 11.4). The Phase I Reintroduction Plan would also include development of guidelines for the use of a conservation hatchery at Iron Gate Dam or on Fall Creek to more quickly establish naturally producing populations in the wild if deemed necessary.

Once self-sustaining populations were established, Phase II Reintroduction Plans would be developed to integrate anadromous fisheries into each state's harvest management plans. Fisheries management, including the setting of harvest levels, would be in accordance with the goal of maintaining a sustainable fishery throughout the basin. A schedule for Phase II Reintroduction Plans cannot be established at this time as it is dependent on the success of the establishment of anadromous fisheries in the upper Klamath Basin.

See Table 2-17 for the general classes of actions that could occur under the Fisheries Reintroduction program during the interim period.

Table 2-17. KBRA Fisheries Reintroduction Projects

KBRA Project	Anticipated Schedule
Reintroduction Plan	2012–2021
Collection Facility	2012–2021
Production Facility	2012–2021
Acclimation Facility	2012–2021
Transport	2015–2021
Monitoring and Evaluation	2012–2021
Hatchery Facilities (at Iron Gate Dam or Fall Creek)	2012–2021

Source: KBRA Appendix C-2

Fisheries Monitoring Plan

The Fisheries Monitoring Plan is intended to direct a cohesive effort to monitor the status and population trends of Chinook and coho salmon, steelhead trout, resident rainbow/redband trout, lamprey, suckers, bull trout, sturgeon, and eulachon (KBRA Section 12.2). Monitoring programs would also collect data on water quantity (*e.g.*, instream flows and Upper Klamath Lake level elevations), water quality (*e.g.*, temperature, nutrient loading, sediment, and algae), the effectiveness of restoration activities, and factors that may limit recovery of fish populations (KBRA Section 12.2).

The Monitoring Plan, to be prepared by the Fish Managers, is scheduled to be completed by March 2012. The results of the monitoring program are to be reviewed in 2020 and 2030 at a minimum. Adjustments in proposed restoration activities would be made on the basis of the results of the monitoring program.

Table 2-18 lists the general classes of actions that may occur under the Fisheries Monitoring program.

Table 2-18. KBRA Fisheries Monitoring Projects

KBRA Project	Anticipated Schedule
Adult Salmonids	2013 start
Juvenile Salmonids	2013 start
Genetics Otololith	2013 start
Hatchery Tagging	2013 start
Disease	2013 start
Green Sturgeon	2013 start
Lamprey	2013 start
Geomorphology	2013 start
Habitat Monitoring	2013 start
Water Quality	2013 start
Upper Klamath Lake Bloom Dynamics	2014 start
Upper Klamath Lake Water Quality/Phytoplankton/Zooplankton	2012–2021
Upper Klamath Lake Internal Load/Bloom Dynamics	2014 start
Upper Klamath Lake External Nutrient Loading	2012–2021
Upper Klamath Lake Analysis of Long-term Data Sets	2014 and 2019 only
Upper Klamath Lake Listed Suckers	2012–2021
Tributaries Water Quality/Nutrients/Sediment	2012–2021
Tributaries Geomorphology/Riparian Vegetation	2012–2021
Tributaries Physical Habitat	2012–2021
Tributaries Listed Suckers	2013 start
Keno Reservoir Water Quality/Algae/Nutrients	2012–2021
Keno Reservoir to Tributaries: Meteorology (Weather Stations)	2012–2021
Remote Sensing Acquisition and Analysis	2013, 2016, and 2019 only

Source: KBRA Appendix C-2

Additional Water for Fish

Many of the components of the KBRA are intended to result in additional instream flows and to retain water in Upper Klamath Lake in order to support fisheries restoration. Most of these actions are intended to benefit both anadromous and sucker populations regardless of the effects of dam removal. A cornerstone of the KBRA is the agreement to limit diversions to Reclamation's Klamath Project in exchange for certain assurances among the parties in the

Oregon water rights adjudication process and with respect to the exercise of certain tribal water rights

Most of the programs that provide additional water for fish are organized under the Water Programs section of the KBRA and are described in greater detail below. These programs include the following:

- Limit on diversions to Reclamation's Klamath Project.
- Interim program of water lease and purchase to reduce diversions from the Klamath River and from tributaries upstream of Upper Klamath Lake.
- Voluntary Water Use Retirement Program (WURP) in upper basin to add up to 30,000 acre-feet of instream water per year to the Upper Klamath Basin including Wood River, Sprague River, Sycan River (except Sycan Marsh), and Williamson River.
- Increased water storage and conservation through specific projects including the following:
  - Breach levees on Williamson River Delta (Completed) - added 28,000 acre-feet of storage.
  - Reconnect Barnes and Agency Lake Ranches to Agency Lake (under study) - would add 63,700 acre-feet of storage.
  - The Wood River Wetlands would add 16,000 acre-feet of storage (under study).
- Monitor groundwater use to ensure that river flows and specified springs are not adversely affected.
- Assess effects of climate change for adaptive management of water resources. Provide at least an additional 10,000 acre-feet of storage in the Upper Basin to allow increased diversions in some years, to mitigate effects of drought, and/or to further fish restoration goals.

Additional Water Storage Projects

Section 18 of the KBRA includes three restoration projects intended to increase the amount of water storage in the Upper Klamath Basin. Full implementation of the KBRA is linked to the completion of specific milestones in these projects.

Wood River Wetland Restoration Project

Bureau of Land Management presently manages the Wood River Wetlands for the purpose of restoring wetlands adjacent to Agency Lake. Under the KBRA, Bureau of Land Management would conduct a study, with input from other KBRA parties, to consider options for managing the Wood River Wetland area that would include operating it as a pumped storage within existing dikes or fully reconnecting the area to Agency Lake by breaching the dikes (KBRA Section 18.2.3). The intent is to provide additional water storage for a total of 16,000 acre-feet of potential water storage capacity between elevations 4,143.3 and 4,136.0 feet. Once the study is completed and a proposed action selected, the appropriate level of NEPA analysis and associated Endangered Species Act (ESA) consultation would need to be conducted. The anticipated schedule for the Wood River Wetland Restoration Project is 2013–2015 (KBRA Appendix C-2). Full implementation of the diversion limitations and associated assurances under the KBRA is linked to completion of the study, NEPA analysis, and ESA compliance and to funding for implementation of the selected alternative.

Agency Lake Ranch and Barnes Ranch Project

In 2007, the Agency Lake/Barnes Ranches were transferred to USFWS to be managed as part of the Upper Klamath National Wildlife Refuge (NWR). Under the KBRA, USFWS would conduct a study with input from other KBRA parties, to consider options for managing the Agency Lake/Barnes Ranches area to enhance water management flexibility in providing benefits for water storage, fish, wildlife, and wetland habitats (KBRA Section 18.2.2). Potential options would include continuing to operate the area as a pumped storage facility or breaching lakeshore levees and reconnecting the land to Agency Lake. The restoration of diked and drained portions of the ranches could add 63,770 acre-feet of potential storage capacity to Upper Klamath Lake between elevations 4,143.3 and 4,136.0 feet. Once the study is completed and a proposed action is selected, the appropriate level of NEPA analysis and associated ESA compliance would need to be conducted. The anticipated schedule for the Agency Lake/Barnes Ranches Project is between 2013 and 2015 (KBRA Appendix C-2). Full implementation of the diversion limitations and associated assurances under the KBRA is linked to completion of the study, NEPA analysis, and ESA compliance and to funding for implementation of the selected alternative.

Additional Water Storage

The KBRA includes provisions for further investigation and acquisition of at least an additional 10,000 acre-feet of storage (KBRA Section 18.3 and 15.1.1). This additional storage capacity would be in addition to the instream water and Upper Klamath Lake water storage benefits expected from the WURP and the water storage projects described above. Any project identified in the future that could provide this additional storage may need to comply with separate NEPA evaluations prior to implementation. The first 10,000 acre-feet of additional storage capacity is one of the identified milestones that would allow for increased diversion to Reclamation's Klamath Project users during the irrigation season in some years (KBRA Section 15.1.1).

Water and Power Programs

The Water and Power Programs in the KBRA address water supply reliability and power affordability for on- and off-Project agricultural users, and for moving water through the area of Reclamation's Klamath Project (Figure 2-13). These plans are intended to help all water users in the basin to be better prepared for reasonably foreseeable events and unexpected conditions.

Plans and programs to be developed and implemented under the Water and Power Program of the KBRA are described in the following sections and include:

- On-Project Plan
- Winter Shortage Plan
- WURP
- Off-Project Water Settlement
- Off-Project Reliance Program Plan
- Power for Water Management Plan
- Drought Plan
- Emergency Response Plan
- Climate Change Evaluation
- Interim Flow and Lake Level Protection Plan
- Environmental Water Program

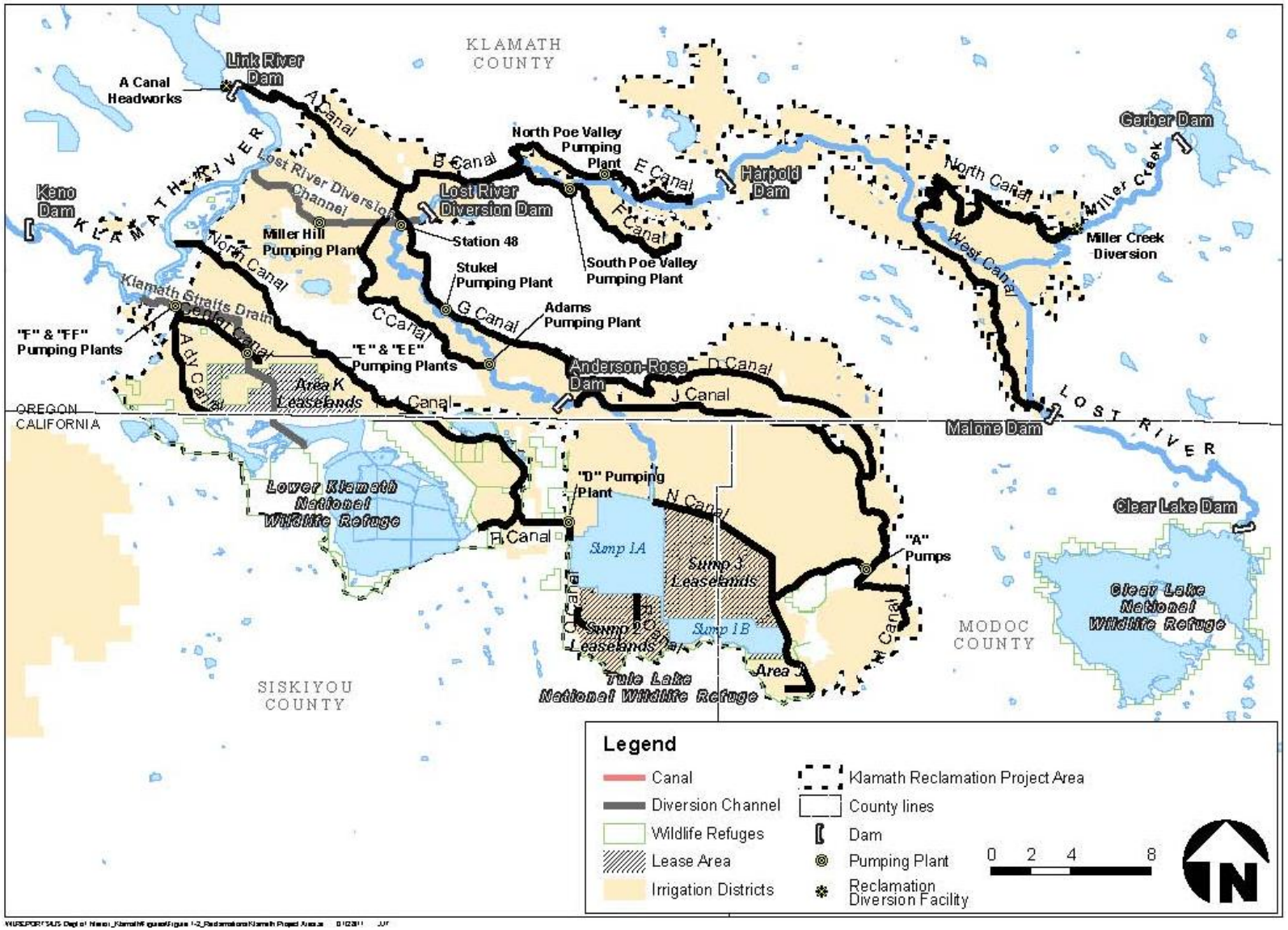


Figure 2-13. On-Project Area

On-Project Water Management

Diversion Limitations

The proposed limitations on diversions to Reclamation's Klamath Project are described in Section 15 and Appendix E-1 of the KBRA. The diversion limitations would result in the availability of irrigation water to be approximately 100,000 acre-feet less than the current demand in the driest years to protect mainstem flows. Implementation of the diversion limitations would include assurances of increased reliability of diversions.

The amount of water that can be diverted to on-Project users, including the Lower Klamath NWR and Tule Lake NWR, varies by season and by water year forecast (whether a year is forecast to be wet or dry) (Table 2-19). The forecast to be used to set diversion limits each year is the Natural Resources Conservation Service 50 percent exceedence forecast for net inflow to Upper Klamath Lake. The 50 percent exceedence forecast is a prediction that there is a 50 percent chance that the actual stream flow will exceed the forecast value (and a 50 percent chance that flows will be less than the forecast value). Although Reclamation's Klamath Project diverts water from a variety of sources, the Upper Klamath Lake forecast would be used to set the diversion limits each Spring and would generally characterize whether a particular year is expected to be wet or dry.

Table 2-19. Reclamation's Klamath Project Diversion Limitations per KBRA Appendix E-1

Season	Forecast (acre-feet)[1]	Diversion Limits (acre-feet)
Phase I[2]		
March–October		
	287,000 or less	378,000 (which includes a 48,000 Refuge Allocation (RA))
	287,000 to 569,000	378,000 to 420,640 (which includes 48,000 to 55,640 for the RA)[3]
	More than 569,000	445,000 (which includes a 60,000 RA)
November–February	N/A	80,000 (which includes a 35,000 RA)
Phase II[2]		
March–October	287,000 or less	388,000 (which includes a 48,000 RA)
	287,000 to 569,000	388,000 to 430,640 (which includes 48,000 to 55,640 for the RA)[4]
	More than 569,000	445,000 (which includes a 60,000 RA)
November–February	N/A	80,000 (which includes a 35,000 RA)

Notes

1. "Forecast" means the March 1st Natural Resources Conservation Service 50% exceedence forecast (meaning there is a 50% chance that flow will exceed the forecast amount) for net inflow to Upper Klamath Lake during the period of April 1 to September 30.
2. Phase I of the diversion limits represent the baseline agreement. Phase II allows additional diversions up to 10,000 acre-feet under certain circumstances and would apply after i) the physical removal of the dams and a free-flowing condition and volitional fish passage has been restored; or ii) 10,000 acre-feet of new storage has been developed in the upper basin; or iii) determination after February 1, 2020 that the increase is appropriate.
3. The Phase I allowable diversion in thousands of acre-feet is calculated by the formula 378+{42.64 x [(Forecast – 287) / 282]} and the refuge allocation is calculated by the formula 48 + {7.64 x [(Forecast – 287) / 282]}.
4. The Phase II allowable diversion in thousands of acre-feet is calculated by the formula 388+{42.64 x [(Forecast – 287) / 282]} and the refuge allocation is calculated by the formula 48 + {7.64 x [(Forecast – 287) / 282]}.

Reclamation's Klamath Project would follow these limitations as much as practicable during the interim period before full implementation of the On-Project Plan. The On-Project Plan would identify what measures might be needed to fully implement the diversion limitations, such as conservation easements or efficiency measures. However, until the On-Project Plan is fully implemented, it might not be possible for water managers to comply completely with the diversion limitations in all years. Full implementation of the On-Project Plan is defined as completion of any measures necessary to allow full implementation of the diversion limitations.

The diversion limitations would not be binding on the parties to the KBRA until Appendix E-1 is filed in an appropriate forum. Appendix E-1 is currently formatted as a filing in the Oregon Water Resources Department (OWRD) water rights adjudication process; however, it is anticipated that that adjudication process will be completed before the Appendix is filed. In that case, the appendix would be reformatted for filing with the most appropriate forum and context, which likely would include a filing with OWRD as it concerns matters of water rights. Prior to filing, the appendix would be signed by the Department of the Interior, Reclamation and USFWS, and irrigation districts within the Klamath Project. Figure 2-14 shows the key KBRA milestones towards full implementation of diversion limits.

Additional On-Project Water Management Provisions

The KBRA contains additional provisions regarding management of water and facilities on Reclamation's Klamath Project. These provisions include direction on a) developing a plan for how water would be allocated and delivered to the Lower Klamath NWR; b) management of lease lands at the Lower Klamath NWR and Tule Lake NWR; c) the use of groundwater and a prohibition on adverse impacts to certain springs; d) payment schedule for D Pumping Plant costs; and e) management of Keno and Link River Dams.

Refuge Allocation and Management

The refuge allocation would be the amount of water that Lower Klamath NWR and Tule Lake NWR would receive from Reclamation's Klamath Project facilities as described in the KBRA and is shown in Table 2-19 (while the refuges receive some water from other sources, the amounts are minimal compared to water from Reclamation's Klamath Project facilities). The Refuge Allocation includes water for a) Lower Klamath NWR wetlands; b) Lower Klamath NWR cooperative farming lands; c) refilling of the Tule Lake NWR sumps after intentional draining; d) refuge-approved walking wetlands on lease lands, cooperative farm lands, or lands within Reclamation's Klamath Project but outside of the Klamath Basin National Wildlife Refuge System; and e) certain conveyance losses.

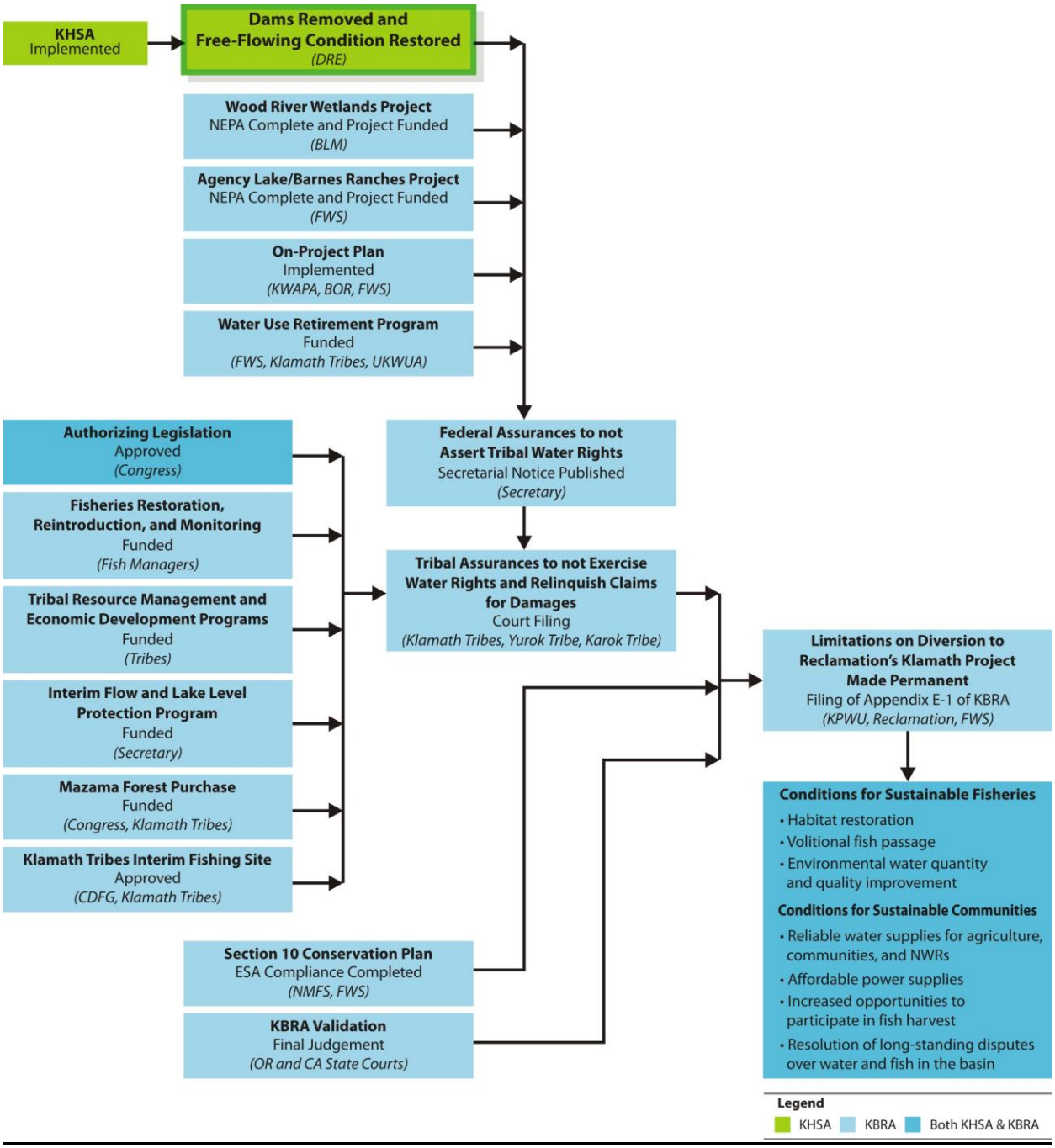


Figure 2-14. Key Milestones before Diversion Limits are Implemented

The parties to the KBRA are to develop agreements on the parameters of delivery of water to the refuges including schedules, volumes by time of year and points of diversion, and a system to determine whether water has "passed through" the refuge without being consumed. Agreement on the general parameters of delivery of the Refuge Allocation would be completed by 2011.

An anticipated schedule for specific projects under this element is identified in Appendix C-2 of the KBRA including:

- Operation and maintenance of North and P Canals in 2014
- Walking wetland construction 2013–2021
- Big Pond Dike construction in 2014

Groundwater Management

The KBRA includes provisions for groundwater studies to evaluate potential effects of groundwater pumping and to provide baseline information needed to meet an objective of "no adverse impact" on specified springs in the basin. An adverse effect on springs is defined in the KBRA as a 6 percent reduction in flow and the year 2000 is used as a baseline. If future studies show that a 6 percent reduction or greater does not affect fisheries, then groundwater withdrawals may be increased. The results of the groundwater studies and ongoing monitoring of the effects of groundwater use would be included in the On-Project Plan (KBRA Section 15.2.4).

The anticipated schedule for the groundwater technical studies is between 2012 and 2014 (KBRA Appendix C-2). United States Geological Survey and OWRD would be the Lead Agencies to conduct groundwater technical investigations. The scope of these studies is described in Appendix E-2 of the KBRA. If investigations or monitoring identify an adverse impact, the parties to the KBRA will work together to modify the On-Project Plan and/or remedy the impact (KBRA Section 15.2.4.B.v). A fund for remedying adverse impacts due to groundwater use is identified in KBRA Appendix C-2.

On-Project Plan

The On-Project Plan is intended to set the framework for implementation of the diversion limits to Reclamation's Klamath Project (KBRA Section 15.2). The On-Project Plan would align supply and demand for water users within Reclamation's Klamath Project and is to include the specific objective that groundwater pumping would not adversely affect springs within the basin.

The On-Project Plan would include details on appropriate responses in the event of summer or winter shortages. The KBRA specifies how and under what circumstances a deficit would be shared among on-Project users and the Lower Klamath NWR and Tule Lake NWR in the event of a summer shortage of water available for diversion. A plan for management of winter shortages is to be developed. The On-Project Plan would reference the Winter Shortage Plan, the Drought Plan, the Emergency Response Plan, and other plans to be developed as appropriate.

Full implementation of the On-Project Plan is to occur no later than March 1, 2022. To implement the On-Project Plan, managers may need to take a variety of actions including acquisition or negotiation of conservation easements; forbearance agreements; land acquisitions;

efficiency measures; conservation measures, development of groundwater sources; or creation of additional storage. The anticipated schedule to develop and implement the On-Project Plan is between 2012 and 2021 (KBRA Appendix C-2).

Winter Shortage Plan

In the event that there is insufficient water available for diversion to Reclamation's Klamath Project during the winter months (November through February) a plan would be developed to identify how shortages would be shared between the Reclamation's Klamath Project water users including the Lower Klamath NWR and Tule Lake NWR. This plan is intended to be completed by 2011 (KBRA Section 15.1.2.F).

Emergency Response Plan

An Emergency Response Plan would be developed to prepare water managers for potential failure of Reclamation's Klamath Project facilities or dikes on Upper Klamath Lake or Lake Ewauna that affects the storage and delivery of water needed to implement the commitments under the KBRA (KBRA Section 19.3). The emergency response plan is to include: a) a process to prepare for potential emergencies; b) funding sources to respond to emergencies; c) the priority of funding emergency responses; d) potential emergency response measures, including emergency NEPA review, as necessary; and e) a process to implement emergency responses. The Emergency Response Plan is intended to be completed in 2011 and implemented as needed.

Water Use Retirement Program

The voluntary WURP is intended to permanently increase the flow of water into Upper Klamath Lake by 30,000 acre-feet per year to support restoration of fish populations (KBRA Section 16.2.2). In exchange for this benefit to the Upper Klamath Lake fisheries, the Klamath Tribes would be willing to settle certain water rights claims with water users in the upper basin.

The WURP is intended to be part of the Off-Project Water Settlement (OPWAS, see below), but may also be implemented independently by the Upper Basin Team. It is expected that the WURP will take up to 10 years to be fully implemented and implementation would start with the completion of the OPWAS in 2012. The anticipated schedule for implementation of the WURP is between 2012 and 2016 (KBRA Appendix C-2).

The WURP may be implemented through a variety of measures including retirement of water rights, forbearance agreements, short-term water leasing, split season irrigation, upland management techniques, water efficiency measures, dry land cropping, and natural storage improvements such as wetlands or improved riparian areas.

The OWRD would determine when the required 30,000 acre-feet of water is permanently assigned to Upper Klamath Lake. The additional storage that would be provided by the Williamson River Delta, Wood River Wetlands, and Agency Lake/Barnes Ranches projects would not apply towards successful implementation of the WURP.

Off-Project Water Management

Off-Project Water Settlement (OPWAS)

The OPWAS is intended to provide a forum for resolving long-standing water disputes between the Upper Klamath Water Users Association, Klamath Tribes, and the Bureau of Indian Affairs (KBRA Section 16) in the Off-Project Area. The Off-Project Area includes the Wood River, Sprague River, Sycan River, and Williamson River sub-basins (Figure 2-15). The intent is to negotiate a settlement that resolves the off-Project irrigators' contests to claims in Tribal Cases under the Klamath Basin water rights adjudication process. In the event that not all such contests are resolved through this process, then the intent is to provide reciprocal assurances for maintenance of instream flows and reliable irrigation water deliveries to the Off-Project Area. Under the KBRA, the OPWAS would include the WURP. The anticipated schedule for development and implementation of the OPWAS is between 2012 and 2021 (KBRA Appendix C-2).

Off-Project Reliance Program

The Off-Project Reliance Program is intended to avoid or mitigate the immediate effects of unexpected circumstances affecting water availability downstream of Upper Klamath Lake that could affect the amount of water available for irrigation in the Off-Project Area (KBRA Section 19.5). Due to the way that water rights are prioritized throughout the basin, circumstances that affect water availability for diversion to on-Project users could affect off-Project users upstream.

The program would be developed by the Upper Klamath Water Users Association with input and assistance from off-Project irrigators, Reclamation, and USFWS. The program is intended to be developed prior to the successful conclusion of the WURP but would not be implemented until a) 30,000 acre-feet of additional flow is added to Upper Klamath Lake through the WURP; b) the OWRD finds that additional instream flow has been added; and c) KBRA Appendix E-1 has become effective (i.e., the diversion limits to Reclamation’s Klamath Project are fully implemented).

Actions that avoid the impacts of unexpected circumstances might include providing funding for water leasing to increase water availability for irrigation in the Upper Klamath Basin, or mitigating the economic impacts of lost agricultural production (KBRA Section 19.5). Because the Off-Project Reliance Program could not be implemented until the WURP was completed and Appendix E-1 was effective, it would not be likely to start until after 2021.

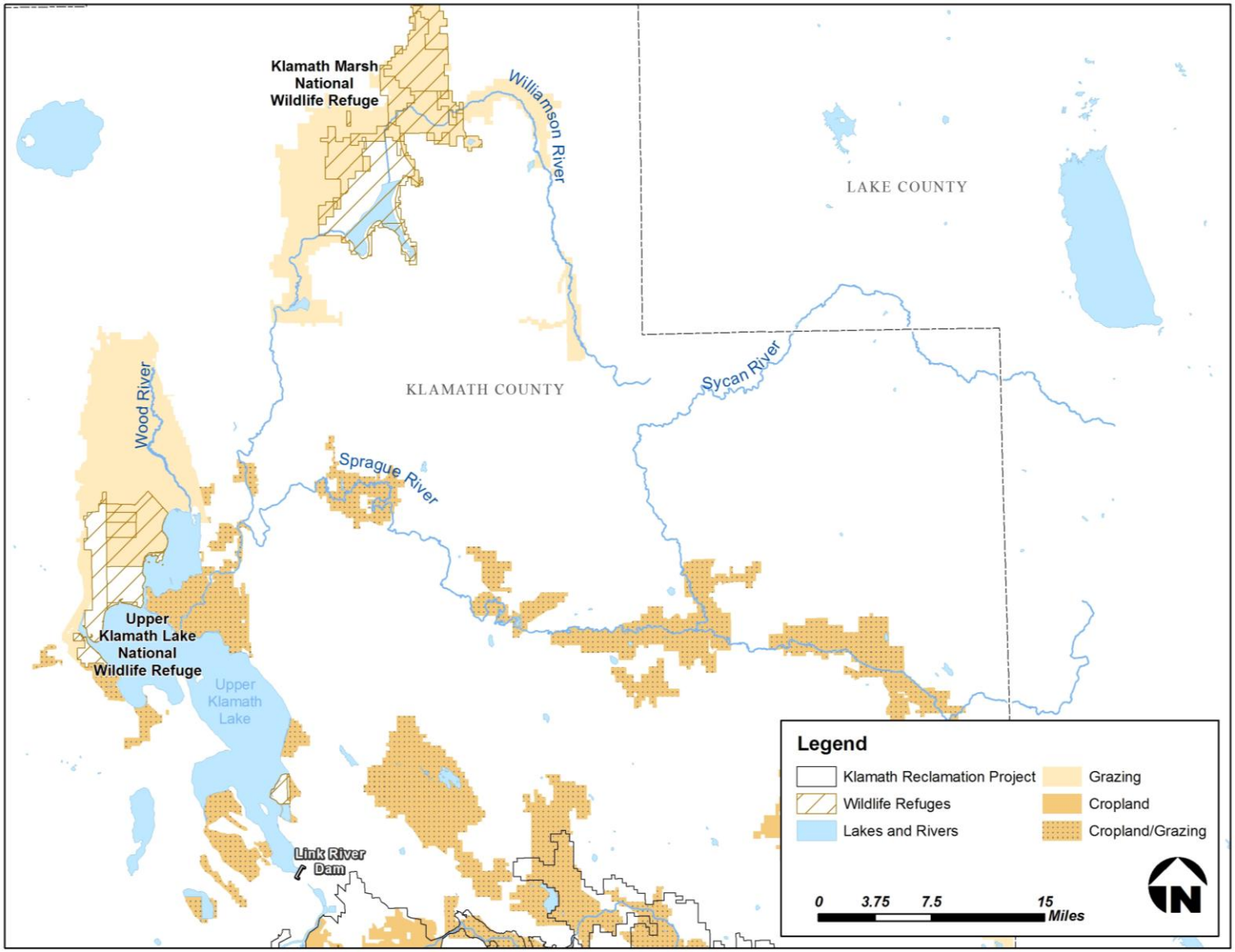


Figure 2-15. Off Project Irrigation Area

Power for Water Management Program

The Power for Water Management program is intended to deliver power to eligible users at a cost that is targeted at or below the average cost for similarly situated Reclamation irrigation and drainage projects in the surrounding area. The goals of the program include providing affordable electricity for (i) efficient use, distribution, and management of water within Reclamation's Klamath Project and the Klamath Basin NWR System, and facilitate the return of water to the Klamath River as part of the implementation and administration of the On-Project Plan; (ii) implementation of the WURP and OPWAS; (iii) meeting the objectives of the Fisheries Restoration Program; and (iv) providing power cost security to assist in maintaining sustainable agricultural communities in the Upper Klamath Basin (KBRA Section 17.1).

Under the KBRA, a power management entity would be established to deliver affordable power to eligible users. The program includes three components: the Interim Power Program, a Federal Power Program, and a Renewable Power Program. The Interim Power Program is intended to maintain the power cost target for eligible users while the other program elements are implemented (KBRA Section 17.5). The anticipated schedule is between 2012 and 2021 (KBRA Appendix C-2), although the specific implementation steps are yet to be identified by the power management entity.

The Federal Power Program is intended to obtain and provide for the transmission and delivery of federal preference power to eligible power users (KBRA Section 17.6). The parties to the KBRA would need to request and be granted an allocation of federal power before this element could be fully implemented.

The Renewable Power Program would increase the efficiency of power users both on- and off-Project and generate renewable energy in order to reduce power costs for eligible power users (KBRA Section 17.7). Implementation of the Renewable Power Program includes development of a financial and engineering plan to identify specific renewable energy resources and energy efficiency measures to be developed or invested in. The financial and engineering plan would specifically evaluate the potential for development of a biomass energy project (KBRA Section 17.7.2). The renewable energy plan is intended to be completed by 2012 (KBRA Appendix C-2).

Drought Plan

The Drought Plan is intended to provide a process to evaluate and adapt water resource management in the event of a drought or an extreme drought so as to avoid or minimize adverse effects. It would identify water and resource management actions such that no Klamath Basin interest shall bear an unreasonable portion of burdens imposed or the risk of loss or injury as a result of drought or extreme drought (KBRA Section 19.2). The Drought Plan would define what conditions constitute a drought year. The water years 1992 and 1994 are defined as representing extreme drought conditions.

Full implementation of the KBRA would include the availability of drought relief funds to help offset the impacts of a drought on water users. Measures suggested in the KBRA that might be taken in the event of a drought include conservation measures, the use of stored water developed for use on Reclamation's Klamath Project, water leasing, use of groundwater, exercise of water

rights priorities, and reduction in the diversion to Reclamation's Klamath Project (KBRA Section 19.2). The Drought Plan is intended to be completed in 2011 and implementation would be ongoing as needed.

Climate Change

The KBRA provides for an assessment of how long-term climate change may affect fisheries and communities in the Klamath Basin (KBRA Section 19.4). The technical assessment of climate change is scheduled to occur in 2013 (KBRA Appendix C-2). Depending on the results of the technical assessment, the parties may need to negotiate supplemental terms to the KBRA in order to achieve the goals of the agreement.

Environmental Water Management

Environmental water is the quantity and quality of instream water available to support fisheries and other aquatic resources. Section 20 of the KBRA lists the obligations of the parties to the KBRA to provide environmental water as described in various sections of the KBRA, including:

- Support dam removal under KHSA (KBRA Section 8).
- Limit diversions to Reclamation's Klamath Project (KBRA Section 15 and Appendix E-1).
- Retire water uses upstream of Upper Klamath Lake to produce additional instream flows and maintain lake levels through a voluntary WURP (KBRA Section 16.2.2).
- Develop additional water storage in the basin (KBRA Section 18).
- Develop and implement Fisheries Restoration Plans (KBRA Section 10).
- Develop and implement Fisheries Reintroduction Plans (KBRA Section11).
- Provide for real-time management of stored environmental water (KBRA Section 20.3).
- Implement an Interim Flow and Lake Level Protection Program (KBRA Section 20.4).
- Support instream water rights applications (KBRA Section 20.5).
- Support the development and implementation of TMDLs on the Klamath River and actions that protect water quality generally (KBRA Section 20.5.4).
- Oppose proposals for additional out-of-basin transfers of water (KBRA Section 20.5.4).

Environmental water may be stored and managed by means such as the operation of the Agency Lake/Barnes Ranches project. In order to determine whether to store water at any particular time, the parties would need to understand the real-time water budget of the basin. Implementation of real-time water management would occur through installation of tools such as water flow monitoring gauges and snowpack gauges (Table 2-20).

Under the KBRA, flows for environmental water and lake level management would be increased by at least 30,000 acre-feet through the voluntary WURP. To achieve environmental water goals during the interim period, an Interim Flow and Lake Level Protection Program is proposed in the KBRA (KBRA Section 20.4). This program would purchase or lease water rights from willing sellers to increase the amount of water in the Klamath River and Upper Klamath Lake until permanent instream water supply enhancements could be put into effect.

Table 2-20. KBRA Environmental Water Management Projects

KBRA Project	Anticipated Schedule
Real Time Water Management	2012–2021
Water Flow Monitoring and Gauges	2012–2021
Snowpack Gauges	2012–2021
Adaptive Management: Science and Analysis	2012–2021
Calibration and improvements to KLAMSIM or other modeling and predictions	2012–2021
Interim Flow and Lake Level Program	2012–2021

Source: KBRA Appendix C-2

Under the KBRA, the parties agree to withdraw any contests to the existing Instream Water Rights applications filed by ODFW or the Oregon State Parks and Recreation Department and to support any other instream water right claims. The KBRA also includes a provision that the parties would support the conversion of existing PacifiCorp water rights to instream uses when the hydroelectric dams are removed from service.

Water protection and improvement are key objectives of the KBRA. However, the KBRA does not include a separately defined water quality program. KBRA Section 20.5 on the protection of environmental water includes general statements about the importance of protecting water quality and the agreement that the parties to the KBRA would support the development and implementation of appropriate TMDLs (KBRA Section 20.5.4). However, this section does not include any specific actions or prerequisites for other actions.

Regulatory Assurances Program

The KBRA provides for reintroduction of salmon and other aquatic species in the Upper Basin, which continued to have potential regulatory or other legal consequences for land or water users upstream of the current site of Iron Gate Dam. Therefore, the KBRA includes a set of regulatory assurances to avoid or minimize new regulation or other legal or funding burdens that might occur to land or water users upstream of Iron Gate Dam from introduction or reintroduction of aquatic species. The KBRA does not supersede existing laws or regulations nor does it modify existing laws or create exemptions. Plans and projects to be developed under the auspices of the KBRA would still need to comply with laws and regulations in force when discretionary decisions are made on those projects and plans.

The KBRA includes a commitment from Reclamation, upon receipt of funding and in compliance with applicable law, to construct entrainment reduction facilities such as fish screens to prevent fish from entering diversion facilities on Reclamation's Klamath Project (KBRA Section 21.1.3). Entrainment would be specifically evaluated and addressed at a) Lost River diversion channel or associated diversion points; b) North Canal, c) ADY Canal; and d) other diversions from Reclamation or Reclamation contractor-owned facilities (Figure 2-13). The anticipated schedule for construction of these entrainment facilities would be between 2019 and 2020.

The parties to the KBRA have also agreed to coordinate with each other and communicate openly on a wide variety of issues in an effort to avoid surprises so that solutions can be sought without acrimony. The KBRA specifically mentions unforeseen circumstances and consequences of restoration and water delivery as situations that might require fresh coordination (KBRA Sections 21.1.4, 21.2, and 21.3).

Development of either a General Conservation Plan or a Habitat Conservation Plan is identified as a means to secure an incidental take permit under Section 10(a)(1)(B) of the Endangered Species Act. This would be one means to avoid or minimize regulatory burdens or costs arising from the reintroduction of fish species to the upper basin (KBRA Section 22). In that light, NOAA Fisheries Service and USFWS will lead the development of a General Conservation Plan or Plans for use by KBRA parties or others to apply for incidental take permits under the Endangered Species Act. While development of a conservation plan could begin as early as 2012, it would not be anticipated that a plan would be approved until the end of the interim period.

The KBRA identifies requirements related to incidental take authorizations under the California Endangered Species Act and provides for coordination between Federal and State agencies related to those authorizations. The California Department of Fish and Game may draft legislation regarding a limited authorization to incidentally take fully protected species that may be affected by implementation of the agreement (KBRA Section 24). The KBRA also contains a provision for consideration of any request that the Oregon Department of Environmental Quality perform a Use Attainability Analysis before proposing any new designated use due to the reintroduction of fish species (KBRA Section 25).

County and Tribal Programs

County Programs

The County Programs under the KBRA recognize that there may be impacts and opportunities for each of the counties within the Klamath Basin. Klamath County has agreed to develop a plan for economic development if funding is available (KBRA Section 27). Funding would potentially come from KBRA authorizations and from state business development programs. The California Water Bond funding legislation, scheduled for a vote in 2012, proposes funding for economic development within Siskiyou County. The KHSA (Appendix G-1) describes this $20 million in economic development funds that would be provided to Siskiyou County as a part of the dam removal action in the event of an Affirmative Determination and a positive vote on the Water Bond Fund. Humboldt and Del Norte Counties are not included in this economic development fund. Funds remaining in the Water Bond fund after covering facilities removal, CEQA mitigation, and actions to secure the City of Yreka's water supply, may be used for fish restoration projects within Siskiyou, Humboldt, and Del Norte Counties.

Similarly there may be property tax revenue losses and gains from the various effects of the KBRA. Property tax revenue changes could occur due to reduced agricultural land values from a) a reduction in water deliveries and b) the surrender of significant water rights. The Klamath County Program within the KBRA includes a provision to compensate Klamath County for these potential revenue changes upon the availability of funding. The anticipated schedule for identification of potential property tax impacts and compensation payments is 2016 (KBRA

Appendix C-2). County programs for Siskiyou, Humboldt, and Del Norte Counties do not include a provision for compensation for changes in property tax revenues that may result from the removal of the hydroelectric facilities.

Tribal Programs

The KBRA includes provisions for each of the affected signatory tribes (the Klamath Tribes, Karuk Tribe, and Yurok Tribe) to receive assistance in developing their capacity to participate in both fisheries management and conservation management activities within the basin (KBRA Sections 31 and 32). In addition, each signatory tribe would prepare an economic development plan and work towards implementing that program (KBRA Sections 31 and 33). Preparation of economic development plans is anticipated to occur in 2013.

The Klamath Tribes have been working with the Trust for Public Lands and have acquired an option to purchase the Mazama Forest in the upper basin, once a part of the tribes' reservation lands. The parties to the KBRA agree to support the Tribes' efforts to secure funding and complete the purchase of this forestland (KBRA Section 33.2). Final acquisition of the Mazama Forest is anticipated to occur in 2012 or 2013. Complete funding to allow the Klamath Tribes to purchase the Mazama Forest is one of the key milestones towards the filing of KBRA Appendix E-1 and the full implementation of the diversion limits to Reclamation's Klamath Project.

Under Section 34 of the KBRA, the Klamath Tribes have petitioned the California Fish and Game Commission to establish an interim fishing site in the reach of the Klamath River between Iron Gate Dam and the Interstate 5 Bridge. The grant of this petition is one of the key milestones toward implementation of the KBRA.

2.4.4 Alternative 3: Partial Facilities Removal of Four Dams

The primary purpose of removing dams on the Klamath River is to restore volitional fish passage and free-flowing river conditions at each dam site, in order to advance restoration of anadromous fish populations. The Partial Facilities Removal of Four Dams Alternative would achieve these goals by partially removing the Four Facilities. The Partial Facilities Removal of Four Dams Alternative satisfies the KHSA and includes the same IMs as in the Proposed Action, implementation of the KBRA, transfer of Keno Dam to DOI, and decommissioning of PacifiCorp's East Side/West Side facilities. Inflows to Upper Klamath Lake and outflows from Keno Dam are assumed to be the same under the Partial Facilities Removal of Four Dams Alternative as described above for the Proposed Action. Flows through the Hydroelectric Reach and downstream from the Iron Gate Gauge would also be the same as those in the Proposed Action (see Figure 2-8).

The Partial Facilities Removal of Four Dams Alternative would include removal of enough of each dam to allow free-flowing river conditions and volitional fish passage at all times. Under this alternative, portions of each dam would remain in place, along with ancillary buildings and structures such as powerhouses, foundations, tunnels, and pipes. Some of these remaining features would likely require perpetual maintenance and security measures to prevent unauthorized entry. All tunnel openings would be sealed with reinforced concrete to eliminate trespass concerns. All oils, hydraulic fluids, and other potential contaminants found in

powerhouses and machinery would be removed prior to final decommissioning and securing of buildings. Table 2-21 provides a summary of facilities that would be removed or retained under the Partial Facilities Removal of Four Dams Alternative.

Table 2-21. Summary of Features to be Removed or Retained with Alternative 3[1,2]

Feature	J.C. Boyle	Copco 1	Copco 2	Iron Gate
Embankment/earth fill dam	Remove		Retain	Remove
Concrete dam structure	Remove	Remove	Remove	
Concrete wingwalls			Retain Right Wall	
Reservoir power intake structure	Retain	Retain	Retain	Remove
Spillway	Remove	Remove	Remove	Retain
Spillway control gates	Remove	Remove	Remove	
Concrete fish ladder	Remove			Remove
Concrete flume headgate structure	Retain			
Concrete canal intake screen	Retain			
Concrete flume	Remove Walls			
Concrete canal spillway	Remove			
Tunnel intake structure	Remove	Retain	Retain	Remove
Tunnel portals	Plug	Plug	Plug	Plug
Steel pipeline & supports	Retain			
Steel surge tank	Remove			
Wood-stave penstock			Remove	
Penstocks, supports, anchors	Remove	Retain	Retain	Remove
Powerhouse building		Retain	Retain	Retain
Powerhouse gantry crane	Remove			
Powerhouse concrete slab/structure	Retain	Retain	Retain	Retain
Powerhouse hazardous materials	Remove	Remove	Remove	Remove
Tailrace flume walls	Retain			
Tailrace channel	Fill	Fill	Fill	Fill
Switchyard	Remove	Remove	Retain	Remove
Warehouse & support buildings	Remove		Retain	
Fish Hatchery				Retain

Notes

1. Grayed-out cells indicate features that are not present at existing dam facilities and would therefore not need to be removed or retained.
2. Features indicated as retained under the Partial Facilities Removal of Dour Dams Alternative are features that would be removed as part of the Proposed Action/Full Facilities Removal of Four Dams Alternative.

2.4.4.1 Deconstruction Actions

Deconstruction techniques for the Partial Facilities Removal of Four Dams Alternative are the same as for the Proposed Action, with no specialized means or methods necessary. Partial facilities removal would be completed during a 1-year period, and dam removal at each site would require the same equipment as the Proposed Action. The following sections describe the scope of work and features for partial removal of each dam under this alternative.

J.C. Boyle

Partial facilities removal would require the complete removal of the embankment section, gated concrete spillway section, and concrete cutoff wall to the bedrock foundation. The DRE would also do the following:

- Remove the lower portion of the fish ladder to prevent potential fish stranding during peak flow events.
- Remove the abutment wall and upper portion of the fish ladder, because they could become unstable after the removal of the embankment and spillway sections.
- Recoat the 14-foot-diameter steel pipeline and supports to encapsulate potential heavy metals.
- Remove concrete walls for the water conveyance canal to allow drainage and animal migration, and prevent collapse due to rockfall.
- Remove the 78-foot-tall steel surge tank and the 150-ton gantry crane to prevent a potential future stability problem during a large seismic event.
- Remove the penstocks to avoid long-term maintenance issues related to the steel, which likely has coatings containing heavy metals.
- Plug the downstream tunnel portal with concrete to avoid unauthorized entry.
- Remove the switchyard and warehouse building.
- Fence and seal the powerhouse

Under the Partial Facilities Removal of Four Dams Alternative, the DRE would not remove the water intake structure, left abutment concrete gravity section, concrete headgate structure, intake screen, steel pipeline and supports, tailrace walls, and powerhouse concrete slab and structure, as shown in Figure 2-16. The DRE would not fill and stabilize the headcut downstream of the forebay overflow discharge canal (as in the Proposed Action) because it would require a large quantity of material that would not be available; partial removal would not produce as much concrete rubble as full removal would.

The DRE would leave the mechanical and electrical equipment in place with all power connections to the outside removed; however, it would remove any oil in the turbine governor and hydraulic control systems, transformers, oil storage tanks, or other equipment. The DRE would also remove other mechanical and electrical equipment containing potentially hazardous materials.

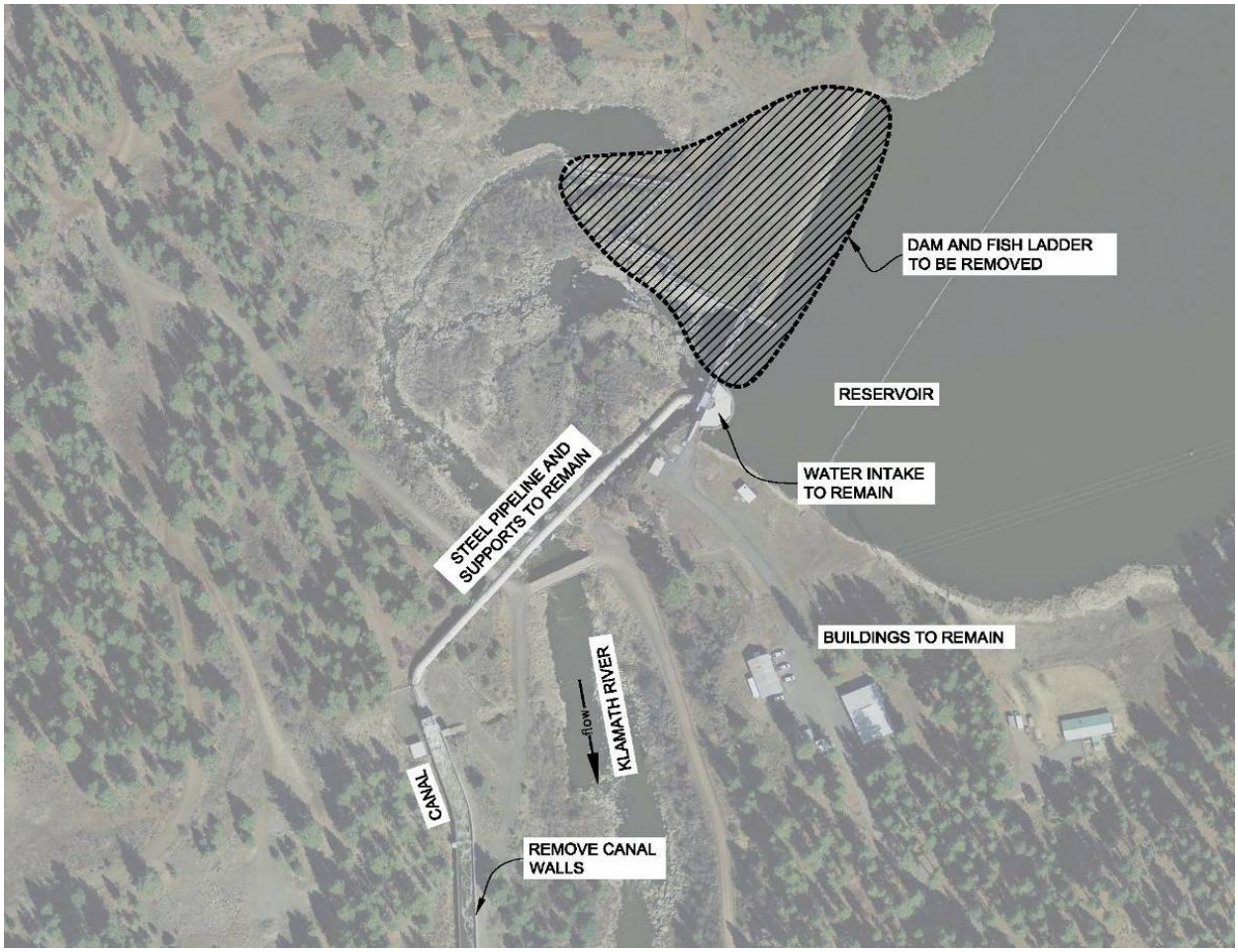


Figure 2-16. View of J.C. Boyle Dam showing portion of dam and fish ladder to be removed for the Partial Facilities Removal Alternative

Copco 1 Dam and Powerhouse

To create a free-flowing condition and volitional fish passage through the Copco 1 site, the DRE would:

- Remove the concrete gravity arch dam and associated facilities (spillway gates, bridge deck, and piers) between the left abutment rock and the concrete intake structure on the right abutment to 5 feet below the existing streambed level at the dam.
- Remove the two concrete gate houses on the right abutment intake structure if necessary to provide workspace for a large crane.
- Seal the downstream end of the intake tunnel portal with concrete to avoid unauthorized entry.
- Remove unused transmission lines, poles, and the switchyard.
- Seal and fence the powerhouse.

Under the Partial Facilities Removal of Four Dams Alternative, the DRE would not remove the power generation water intake structure, penstocks, and powerhouse (Figure 2-17). Retention of these structures would require long-term maintenance, including the preservation of any items with coatings containing heavy metals. The DRE would handle mechanical and electrical equipment and equipment containing potentially hazardous materials in the same manner as for the J.C. Boyle Dam removal under this alternative.

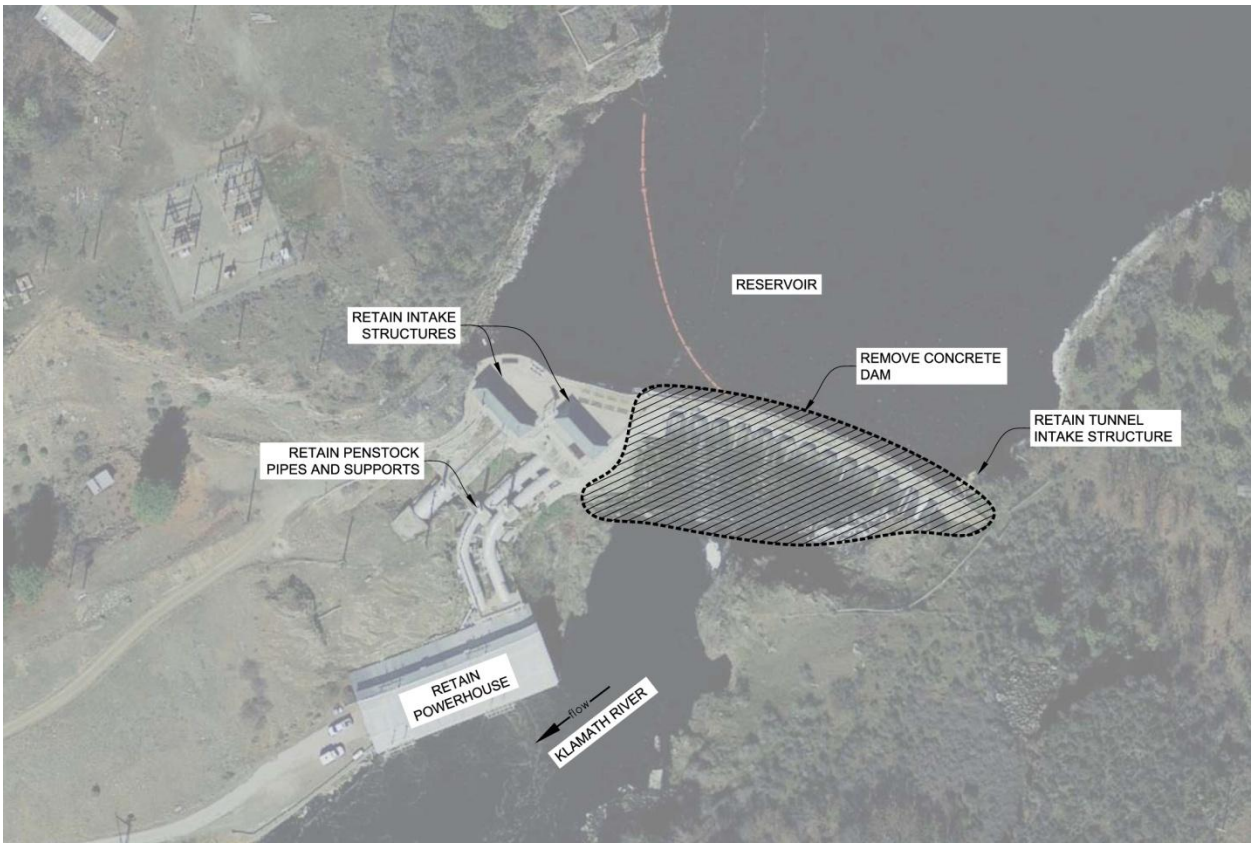


Figure 2-17. Copco 1 showing portion of dam to be removed for the Partial Facilities Removal Alternative

Copco 2 Dam and Powerhouse

To create a free-flowing condition and volitional fish passage through the Copco 2 site, the DRE would take the following actions:

- Remove the concrete gated spillway structure and concrete end sill between the existing sidewalls (see Figure 2-18) as well as associated facilities (spillway gates, bridge deck, and piers).
- Remove wood-stave penstock.
- Remove equipment on the right abutment embankment section to facilitate construction access to the gated spillway.
- Seal and fence powerhouse.

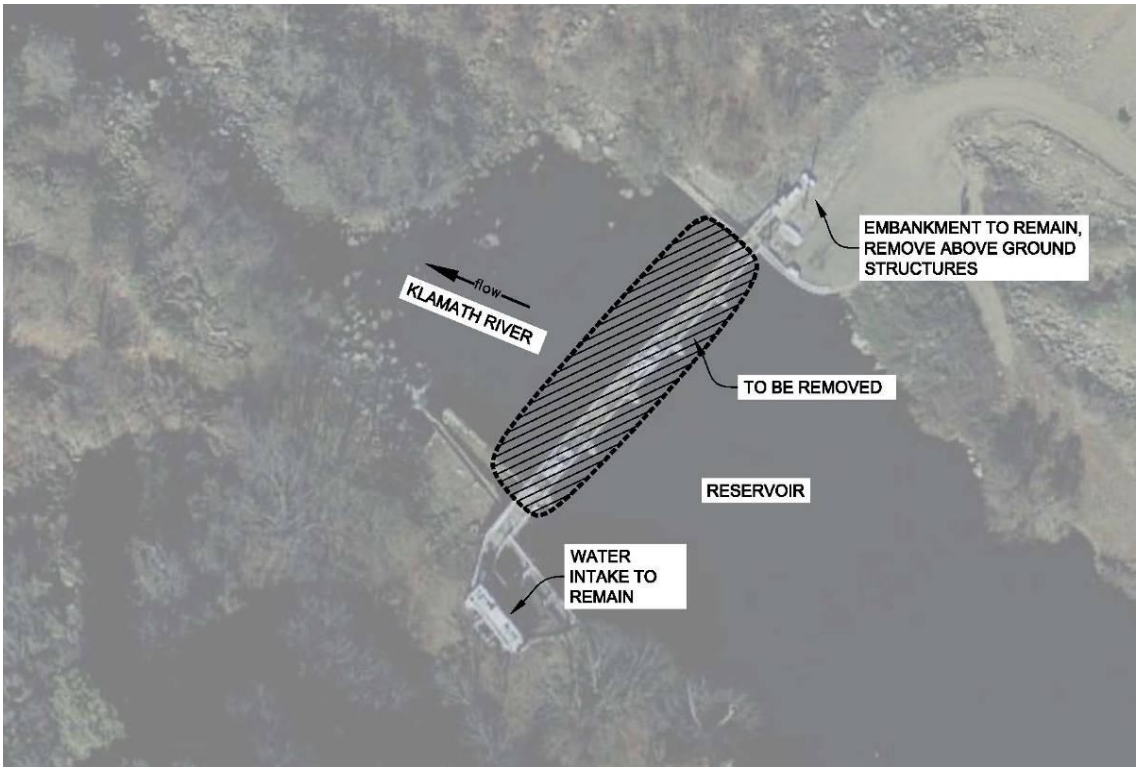


Figure 2-18. Copco 2 dam showing portion of dam to be removed for the Partial Facilities Removal Alternative

Under the Partial Facilities Removal of Four Dams Alternative, the embankment section on river right, intake structure on river left, conveyance system to the powerhouse, and powerhouse would remain in place. A small portion of the downstream basin apron slab would remain intact for structural stability of the right sidewall, provided that a potential fish barrier would not result.

The DRE would handle mechanical and electrical equipment and equipment containing potentially hazardous materials in the same manner as for the J.C. Boyle and Copco 1 Dam removals under this alternative.

Iron Gate Dam and Powerhouse

Theoretically, the DRE could notch Iron Gate Dam instead of removing the full dam. The river channel would need a 100-foot opening to accommodate fish passage at high flows. Figure 2-19 shows Iron Gate Dam with a 100-foot-wide notch at the base of the dam with potential stable side slopes to the top of the dam. This figure illustrates that notching the dam would remove nearly the entire dam and would create the need to protect the newly exposed inner core of the dam for stability. The amount of effort required to notch the dam is comparable to removing the entire earthfill embankment. Likewise, the stabilization costs of the remaining structure would be comparable to the costs to remove the minor amount of remaining material. Therefore, under this alternative, the DRE would remove the entire embankment dam, concrete water intakes, water supply pipes, and fish facilities at the base of the dam, with methods and equipment requirements as described for the Proposed Action.

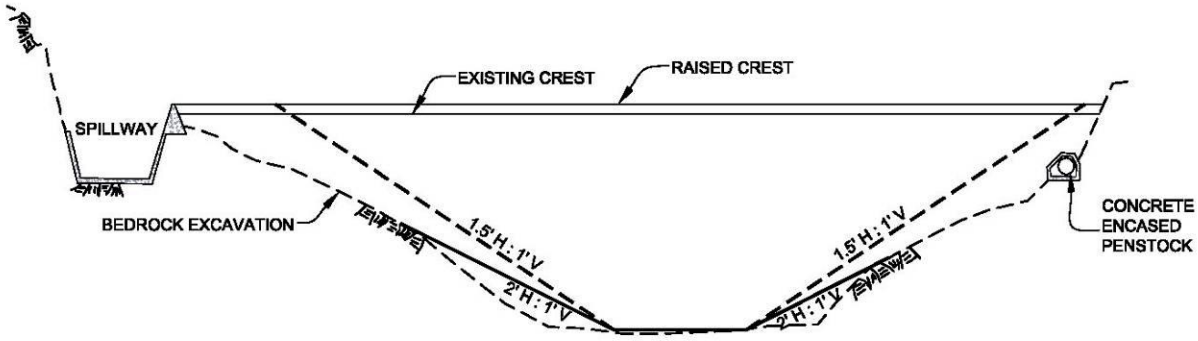


Figure 2-19. Section view of Iron Gate Dam showing 100-foot-wide bottom notch with different potential side slopes

Facilities that would remain include the existing concrete spillway and powerhouse (Figure 2-20). The DRE would fill the spillway and chute with material removed from the dam embankment. The DRE would seal all tunnels at the upstream and downstream openings using reinforced concrete plugs to prevent unauthorized entry.

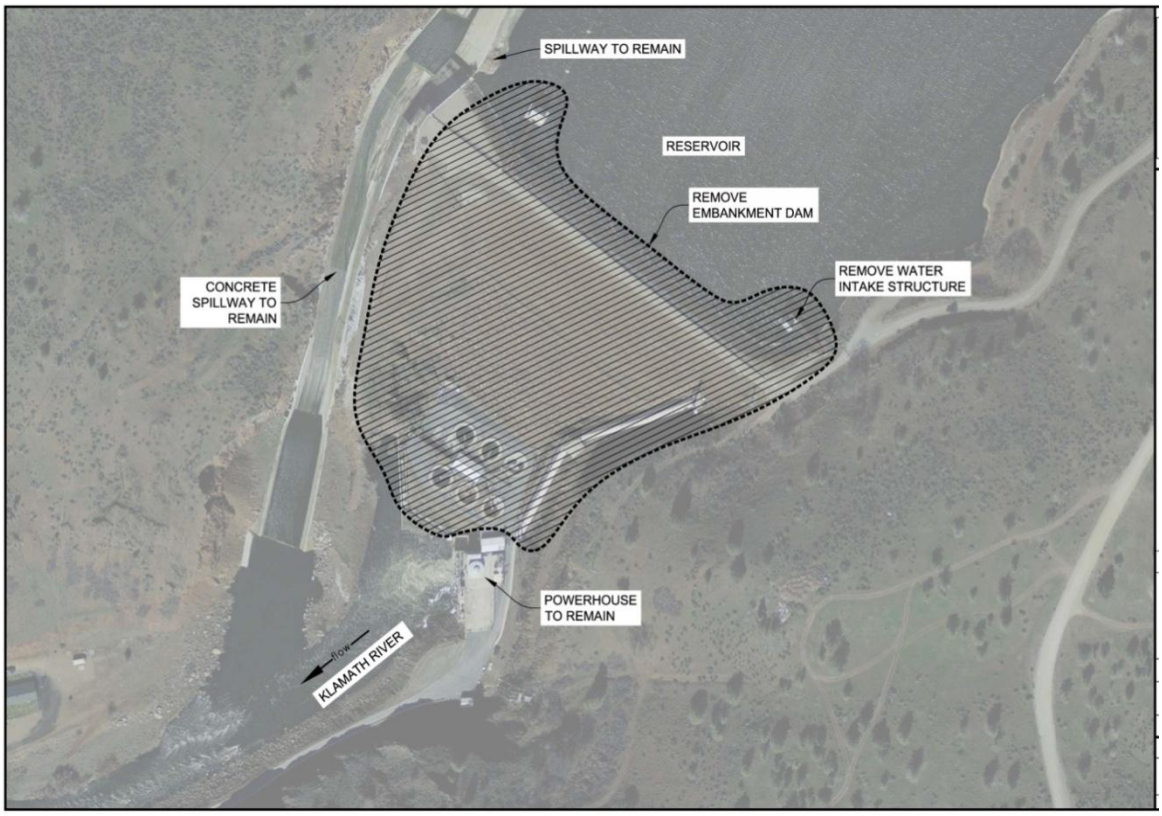


Figure 2-20. Iron Gate dam showing portion of dam to be removed for the Partial Facilities Removal Alternative

The Iron Gate Fish Hatchery downstream of the dam would remain in place. The KHSA requires PacifiCorp to secure an alternate water source to replace the existing water supply pipe from Iron Gate Dam.

Retention of the Iron Gate powerhouse would require the structure to be sealed and fenced. The DRE would handle mechanical and electrical equipment and equipment containing potentially hazardous materials in the same manner as for the other dam removals under this alternative.

2.4.4.2 Schedule

The Partial Facilities Removal of Four Dams Alternative would follow a schedule similar to that of the Proposed Action. Figure 2-21 provides a schedule that is consistent with the schedule in Section 2.3.2 for Full Facilities Removal. The staging and methods would remain the same; however, the DRE would only remove portions of the dam and facilities. This alternative's schedule includes time to secure retained facilities by removing hazardous materials and installing fences and similar security features to prevent unwanted entry. Therefore, it is not

likely that this alternative would result in a substantially shorter project schedule than the Proposed Action.

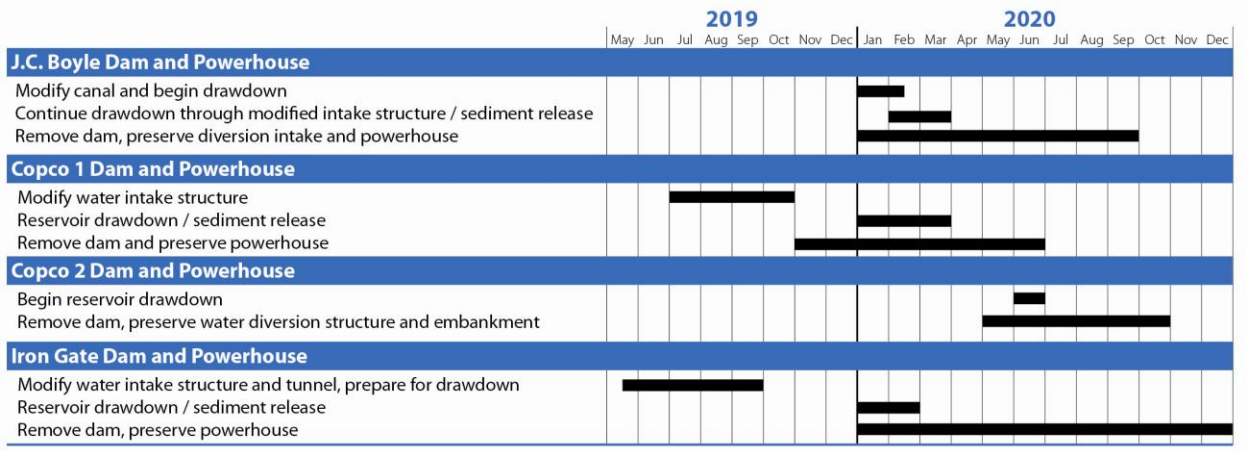


Figure 2-21. Anticipated Schedule for Partial Facilities Removal

2.4.4.3 Workforce

Table 2-22 shows the estimated workforce necessary for deconstruction at each facility. The crews for the removals at Copco 1 and 2 Dams could move between the projects as necessary to perform critical path work, to reduce overall workforce numbers, depending on how the contract is released for the projects.

Table 2-22. Estimated Construction Workforce for Partial Removal at each Facility

Facility	Estimated Average Construction Workforce	Duration	Estimated Peak Workforce	Peak Period
J.C. Boyle	20 to 30 people	10 months	40–45	Jul 2020–Sep 2020
Copco 1	25 to 35 people	12 months	50–55	Nov 2019–Apr 2020
Copco 2	20 to 30 people	7 months	35–40	May 2020–Aug 2020
Iron Gate	30 to 40 people	18 months	75–80	Jun 2020–Sep 2020

2.4.4.4 Environmental Measures

The Partial Facilities Removal of Four Dams Alternative would incorporate standard measures to reduce environmental effects. These measures would be the same as those included in the Proposed Action (see Section 2.4.3).

2.4.4.5 Reservoir Restoration

The Partial Facilities Removal of Four Dams Alternative would include the same reservoir restoration actions described above for the Proposed Action. The restoration actions would include bank stabilization, revegetation, and decommissioning and or modification to existing recreation facilities surrounding the reservoir. Securing facilities left in place following partial facilities removal is not considered a component of this reservoir restoration action and would be completed as described above for this alternative.

2.4.4.6 Recreation Facilities

Changes to the recreation facilities surrounding the existing reservoirs would be the same as those in the Proposed Action (see Table 2-13).

2.4.4.7 Keno Transfer

The Partial Facilities Removal of Four Dams Alternative would include the transfer of Keno Dam as a connected action in the same fashion as for the Proposed Action. The description of the transfer presented in Section 2.4.3.7 characterizes how the transfer would be executed under the Partial Facilities Removal of Four Dams Alternative.

2.4.4.8 East Side/West Side Facility Decommissioning – Programmatic Measure

The Partial Facilities Removal of Four Dams Alternative would include decommissioning the East Side and West Side Facilities in the same fashion as the Proposed Action. The description of the facility decommissioning presented in Section 2.3.2.8 characterizes how decommissioning would be completed under the Partial Facilities Removal of Four Dams Alternative.

2.4.4.9 KBRA – Programmatic Measures

The Partial Facilities Removal Alternative would include implementation of the KBRA in the same fashion as the Proposed Action. The description of the KBRA presented in Section 2.4.2.8 characterizes the plans, programs, and actions that would be pursued under the Partial Facilities Removal of Four Dams Alternative.

2.4.5 Alternative 4: Fish Passage at Four Dams

Alternative 4 would provide upstream and downstream fish passage at the Four Facilities. The Fish Passage at Four Dams Alternative would not satisfy the KHSA; consequently, the KBRA would not be implemented (although ongoing restoration activities in the No Action/No Project Alternative may continue). For the purposes of this analysis, alternatives that would not result in full implementation of the KHSA do not include the KBRA as a connected action to the alternative. Additionally, the transfer Keno Dam to DOI would not move forward as a connected action.

The description of Alternative 4 uses information from the *United States Department of the Interior and National Marine Fisheries Service Modified Prescriptions for Fishways and Alternatives Analysis Pursuant to Section 18 and Section 33 of the Federal Power Act for the Klamath Hydroelectric Project (FERC Project No. 2082)* (DOI and NOAA Fisheries Service 2007) and from the *Modified Terms and Conditions and Prescriptions for Fishways filed pursuant to Sections 4(e) and 18 of the Federal Power Act* (DOI/BLM 2007). These fishway prescriptions and mandatory conditions were developed during the FERC relicensing process.

Issues of Material Fact associated with the prescriptions and mandatory conditions were challenged; the resulting Administrative Law Judge decision found that the Agencies met their burden of proof on most factual issues in dispute. Attachment B of Appendix A includes the full list of prescriptions and mandatory conditions; a key 4(e) condition requires at least 40 percent of J.C. Boyle inflow to be released into the Bypass Reach. Under this alternative, the J.C. Boyle Powerhouse would produce peaking power only one day a week to coincide with recreation releases. This alternative would generate less power than current production because of the change in peaking operations and the flow requirements for the J.C. Boyle Bypass Reach. Several of the prescriptions include studies to determine if features are necessary (such as spillway and tailrace modification). For the purposes of analysis in this EIS/EIR, Alternative 4 includes some specific fishway facility design and construction details beyond what are specifically required in the prescriptions and are based on designs of similar fishway facilities used at other hydroelectric facilities.

Flows within the Hydroelectric Reach would change compared to the No Action/No Project Alternative because of the prescriptions related to releases from J.C. Boyle Dam and Powerplant. Flows downstream from Iron Gate Dam, however, would be similar to those in the No Action/No Project Alternative (see Figure 2-7).

This alternative would be implemented through FERC licensure to an entity that would operate the Four Facilities (the "Hydropower Licensee"). The Hydropower Licensee would need to re-enter the FERC process to implement this alternative. Inflows to Upper Klamath Lake, and outflows from Iron Gate Dam are assumed to be the same under the Fish Passage at Four Dams Alternative as described above for the No Action/No Project Alternative.

This section describes general information about the fish passage facilities that would be constructed, and the following sections discuss aspects unique to each facility. Typical upstream fish passage facilities at each dam would consist of pool and weir type fish ladders to provide the safe, timely, and effective upstream passage of Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout. This type of fish ladder is generally constructed from reinforced concrete and occasionally uses metal or wood hardware for adjustable components. In order to meet the prescribed fish passage criteria (DOI and NOAA Fisheries Service 2007), the fish ladders would use 6-inch steps between each weir that would result in an overall structure slope of 4 and 6 percent. At a minimum, each ladder bay would measure 8 feet long by 6 feet wide by 5 feet deep to meet the minimum pool requirements (NOAA Fisheries Service 2008), which would drive the structure slope of 4 to 6 percent. The FERC Final EIS identified a 10 percent slope, but that slope would not meet current requirements for fish ladders. Figure 2-22 shows an example of a cast-in-place pool and weir fish ladder that is similar to that proposed for upstream fish passage at the Four Facilities under this alternative. Final design of these structures would likely exceed this minimum pool dimension by 50 to 100 percent in order to meet all regulatory criteria and minimize turbulence in the ladder bays. Table 2-23 provides a minimum footprint for each upstream fish ladder.

Figure 2-22. Example of cast-in-place pool and weir fish ladder

Table 2-23. Minimum Structure Footprint and Dimensions for Fish Ladders at Each Dam

Dam	Vertical Drop (ft)	Min. Number of Pools	Min. Structure Length (ft)	Min. Structure Footprint (sq. ft.)
J.C. Boyle	61	122	1,089	8,712
Copco 1	124	249	2,241	17,928
Copco 2	22	44	396	3,168
Iron Gate	157	314	2,826	22,608

Vertical Drop Source: CH2M Hill 2003

The J.C. Boyle and Copco 2 fish ladders are well within typical pool and weir fish ladders being designed today to meet fish passage criteria for the vertical drop. The Copco 1 and Iron Gate fish ladders are substantially longer and have a bigger elevation differential; however, there are two successful examples in Oregon where bigger elevation differentials have been overcome with pool and weir fish ladders for upstream fish passage. The two examples are the Faraday/North Fork ladder on the Clackamas River (196 feet tall, 1.9 miles long) and the Pelton ladder on the Deschutes River (230 feet tall, 2.8 miles long) (Ratliff et. al. 1999). The Pelton ladder was shut down in 1968 primarily due to downstream juvenile passage and not upstream passage.

Fish ladders would be designed to allow passage 90 percent of the time that migratory fish would be present in the project area. For the extreme high and low flows, or 10 percent of the time, hydraulic conditions might prevent the ladders from meeting fish passage criteria. Fishway prescriptions require two downstream entrances and associated entrance pools for each fish ladder (DOI and NOAA Fisheries Service 2007). All fish ladders would require an auxiliary water supply (AWS) to ensure adequate attraction flows at the downstream and to draw fish into the fish ladder and moderate water temperatures. The AWS would consist of a pipeline or intake that draws water from the reservoir and releases it in the fish ladder and near the fishway entrance pools. To accommodate increased flows, the downstream bays of the fish ladder would be larger than upstream bays in the fish ladder.

Downstream fish passage facilities would vary at each dam. Generally, the facilities would include V-screens or floating surface bypass collectors (FSBC) to screen the fish away from the intake structures for the power generation facilities and the spillways (if they are unsuitable for downstream passage). Table 2-24 summarizes the fish passage facilities that would be required at each dam under this alternative.

Table 2-24. Fish Passage Improvements under the Fish Passage at Four Dams Alternative

Dam	Upstream Fish Passage	Spillway Modifications[1]	Tailrace Barrier[1]	Screens & Bypass
J.C. Boyle	New fish ladder over dam with auxiliary water supply (AWS) for attraction	Spillway modification to provide smooth transition	Extend river bank and install cutoff screen	New V-screen with fish bypass
Copco 1	New fish ladder over dam with AWS	Surface bypass collector		New V-screen with fish bypass
Copco 2	New fish ladder over dam with AWS		Extend river bank and install cutoff screen	New V-screen with fish bypass
Iron Gate	New fish ladder over dam with AWS, observation and sorting station in fish ladder	Spillway modification to provide smooth transition		New V-screen with fish bypass

Notes:

1. The prescriptions require studies to determine the need for and design of spillway modifications and tailrace barriers. For the purposes of analysis in this EIS/EIR, Alternative 4 includes some specific fishway facility design and construction details that are beyond those required in the prescriptions.

2.4.5.1 Construction Details

Construction of fish ladders represents the bulk of the work under this alternative. The Hydropower Licensee would construct the ladders from reinforced concrete using construction methods typical for civil infrastructure work.

Table 2-25 shows estimated quantities of concrete for each facility.

Table 2-25. Estimated Minimum Amount of Reinforced Concrete Necessary For Fish Ladder at Each Dam

Dam	Reinforced Concrete (yd^3)
J.C. Boyle	2,800
Copco 1	5,800
Copco 2	1,000
Iron Gate	7,000

The Hydropower Licensee would need to control water and isolate the work area from flowing water and aquatic organisms throughout the duration of construction. Control mechanisms would be installed prior to starting work for each dam removal. The Hydropower Licensee could control water in most areas using gravity diversions; however, pumps could be required to dewater isolated ponding. Dewatering would require electric, gasoline, or diesel powered pumps, along with flexible hosing to convey water. Pumps would discharge water away from the river into upland areas to prevent discharge of fine sediments to waterways.

The Hydropower Licensee would work in wet conditions in areas that cannot be dried. For in-water work, the Hydropower Licensee would use physical barriers of a type and in a manner similar to that used under the dam removal alternatives.

The following sections provide a detailed description of necessary fish passage facilities for each dam under the Fish Passage at Four Dams Alternative.

J.C. Boyle Fish Passage Facilities

The J.C. Boyle site has the best access for construction equipment and staging for construction. Equipment and materials could be brought into the site on existing gravel access roads and temporary access roads where necessary.

Upstream Passage

J.C. Boyle Dam has an existing pool and weir concrete fish ladder on the north side of the spillway, but it does not meet current design criteria and must be replaced because of its configuration and poor structural condition. The Fish Passage at Four Dams Alternative would include removal of the existing fish ladder structure and construction of a new pool, weir, and reinforced concrete fish ladder on the north side of the dam spillway, at or near the same location as the existing fish ladder (see Figure 2-23).

The overall difference in water levels from the downstream river to J.C. Boyle Reservoir ranges from 55 to 61 feet, depending on reservoir pool elevation. The new fish passage facilities would have multiple openings into the reservoir to accommodate the reservoir pool fluctuation while maintaining continual upstream passage. The new ladder would have two entrances to accommodate low flow and high flow conditions.

An AWS would be necessary for temperature and attraction flow mitigation. The AWS would draw water from the reservoir through a screened inlet and variable height intake structure to

provide water temperature control. The AWS would pipe water into the fish ladder at two locations.

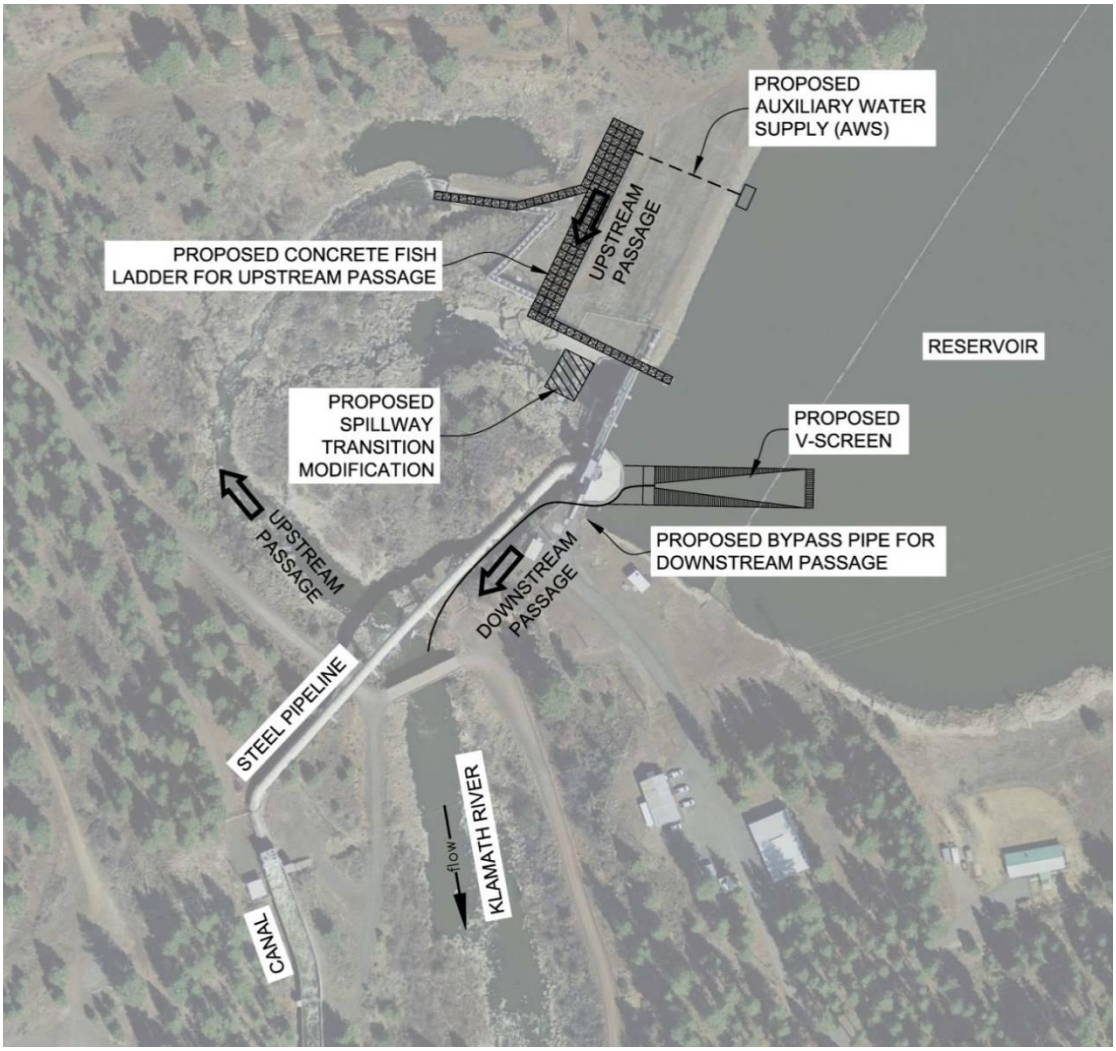


Figure 2-23. Conceptual Layout of J.C. Boyle Fish Passage Facilities

Construction of these facilities would begin with demolition and removal of the existing fish ladder using mechanical means (such as hydraulic shears or hoe-ram). The Hydropower Licensee would then install the new reinforced concrete fish ladder by constructing concrete forms, laying the reinforcement, and pouring concrete. The Hydropower Licensee would construct a cofferdam around the area where the fish ladder enters the reservoir to allow construction in dry conditions.

Downstream Fish Passage – Water Intake

The existing water intake has a design flow of 3,000 cfs, which requires a minimum fish screen of 7,500 square feet based on an approach velocity of 0.4 feet per second (ft/s). The Fish Passage at Four Dams Alternative would include a conventional V-screen at the J.C. Boyle water

intake. The V-screen would terminate in a 36 inch diameter fish bypass pipe (approximately 40 cfs) that would run from the water intake to a bypass facility for recording downstream migrating fish and then continuing on to a controlled outfall in the river downstream of the dam. The V-screen would be stainless steel and the fish return pipe would be standard steel with concrete and steel support structures along the length of the pipe.

The V-screen would be fabricated offsite and installed by a crew of skilled workers using light equipment. This phase of construction would require extensive dewatering and work isolation effort in order to provide a dry or partially isolated work area. Dewatering could require reservoir water level manipulation or construction of coffer barriers with pumps to dewater the work area around the water intakes.

Downstream Fish Passage – Spillway

Radial gates regulate discharge over the J.C. Boyle Dam's concrete spillway section that terminates in an abrupt drop onto bedrock. Modifications to the spillway would likely include removing the drop at the downstream end of the spillway by building a cast-in-place concrete transition and minor channel modifications. This design would likely reduce fish mortality on the rock outcrop below the spillway and provide a smooth transition for downstream passage. Construction would involve a small amount of demolition and concrete placement; methods would be similar to the work on the new fish ladder.

Tailrace Barrier

The power generation turbines at J.C. Boyle Powerhouse are several miles downstream from the dam with a large outlet bay, or tailrace area, that flows into the Klamath River (see Figure 2-2). This tailrace has the potential for false attraction waters and needs a barrier. The Fish Passage at Four Dams Alternative would include extension of the bank of the Klamath River and installation of a stainless steel, wedge-wire cutoff screen.

Copco 1 Fish Passage Facilities

The Copco 1 Dam site has difficult site access because of steep canyon terrain. The Fish Passage at Four Dams Alternative would include construction of temporary roads for site access and other special provisions to move materials, such as a tower crane or aerial tramway.

Upstream Passage

Fish Passage at Four Dams Alternative would include a new pool and weir fish ladder on the right side of Copco 1 Dam for upstream fish passage. The fish ladder would have an AWS plumbed into it at two locations to moderate water temperatures, flow in the fishway, and attraction flows at the downstream end of the fishway. The downstream entrance of the fish ladder would have two entrances for low water and high water conditions, as shown in Figure 2-24. The upstream end of the fish ladder that enters the reservoir area would also have multiple openings to accommodate water level fluctuations. Construction would require installation of the cast-in place concrete ladder and isolation of the area where the ladder connects to the reservoir.

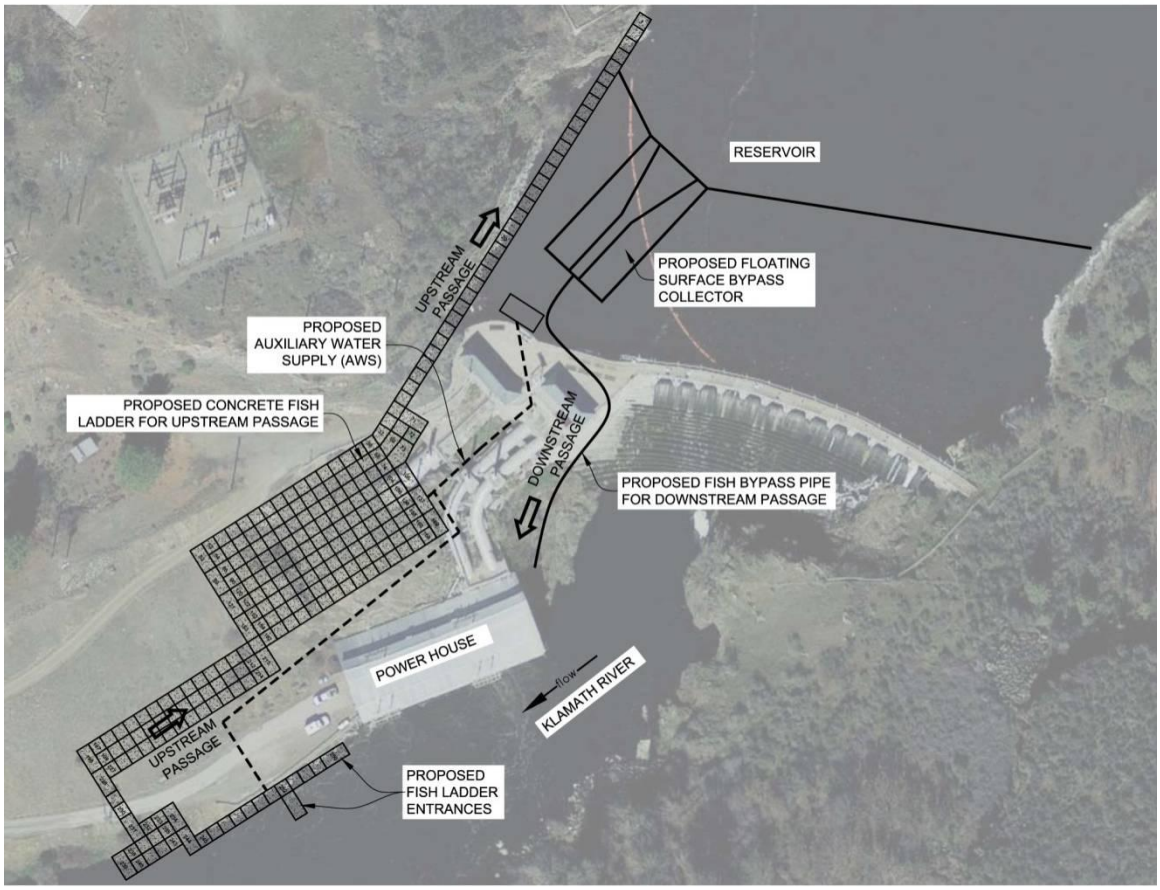


Figure 2-24. Copco 1 Fish Ladder Configuration and Floating Surface Bypass Collector

Downstream Fish Passage

The existing facilities at Copco 1 Dam are not conducive to downstream fish passage because the juvenile salmonids travelling downstream would flow through the intake to the power generation facility or over the dam spillway during high flows. The Fish Passage at Four Dams Alternative would include a V-screen as the primary measure to ensure safe downstream passage (DOI and NOAA Fisheries Service 2007).

Depending on the frequency of spill, an FSBC may also be necessary to prevent fish from moving toward the spillway area. For the purposes of this analysis, the Fish Passage at Four Dams Alternative includes construction of an FSBC that is integrated with the V-screen for Copco 1 Reservoir with full-depth nets. The FSBC would be placed on the reservoir surface to protect the entire spillway area. The FSBC would be fabricated off-site and shipped to the site using standard flatbed trucks. The Hydropower Licensee would assemble the pieces on-site to create the larger body of the FSBC. Once the structure was assembled, it would be floated into place near the water intake area and secured. Reservoir guide nets would facilitate fish passage through the bypass collector.

The FSBC would be a steel structure using a typical V-screen configuration similar to Upper Baker Dam in Washington (see Figure 2-25). The existing power generation water intake has a design flow of 3,200 cfs, which requires a minimum fish screen of 8,000 square feet based on an approach velocity of 0.4 ft/s. The main FSBC would be at the intake structure on the right side of the dam. The FSBC would be anchored to the existing rock and concrete dam structure to ensure stability The FSBC would direct fish to an approximately 36 inch diameter bypass pipe with a capacity of more than 60 cfs.

Figure 2-25. Example of Floating Surface Bypass Collector in Upper Baker Dam, Washington

Tailrace Barrier

The Copco 1 Powerhouse configuration is similar to the Iron Gate facility, which would not include a tailrace barrier based on observed conditions and past performance. Prescriptions include a study to determine if a tailrace barrier is necessary. Because of its similarities with Iron Gate, Alternative 4 does not include a tailrace barrier because the study is likely to find that it would not be necessary.

Copco 2 Fish Passage Facilities

The Copco 2 site has difficult access because of the narrow canyon and relatively steep road access into the site. The existing access road would require upgrades such as gravel surfacing and grading.

Upstream Fish Passage

The Fish Passage at Four Dams Alternative includes a concrete pool and weir fish ladder with 6-inch drops to provide volitional fish passage at Copco 2 Dam. The overall difference in water levels from the downstream river to Copco 2 Reservoir is about 20 to 25 feet, depending on

reservoir pool elevations. The new fish passage facilities would accommodate the reservoir pool fluctuation while maintaining continual upstream passage. Construction would require installation of the cast-in place concrete ladder and isolation of the area where the ladder connects to the reservoir.

The pool and weir fish ladder would be on the right side of the concrete spillway structure in the earth embankment. An AWS would be necessary for temperature and attraction flow mitigation. The AWS would draw water from the reservoir through a screened inlet. Figure 2-26 shows a conceptual layout for a fish ladder at Copco 2 Dam.

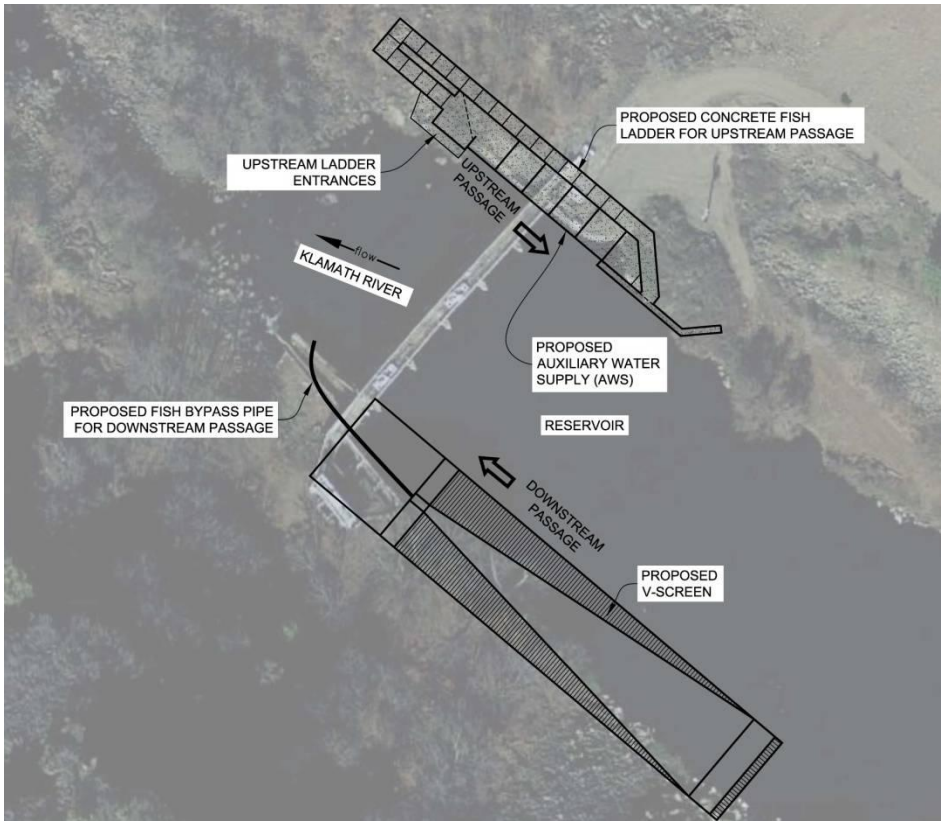


Figure 2-26. Copco 2 Fish Ladder and V-screen, along the left side of the river, for power water diversion

In addition to the fish ladder, a transverse bedrock sill approximately 0.5 miles upstream of the Copco 2 Powerhouse in the Bypass Reach could create a fish passage barrier. A new FERC license would likely increase flows in the Bypass Reach and this barrier would not likely exist. As part of the license renewal process, a study would determine whether corrective measures would be needed at this barrier to provide fish passage. According to the mandatory prescriptions, sufficient flow would need to be released into the Bypass Reach to attract upstream-migrating fish into the fishway entrance pools and ensure that flows are sufficient to attract fish at the point of confluence between the Bypass Reach and the downstream

powerhouse discharges. The prescriptions do not specify a flow rate in the Bypass Reach, but modeling the recommendations indicates that minimum flows would be approximately 438 cfs.

Downstream Fish Passage

The existing power generation water intake at Copco 2 Dam is on the left side of the concrete spillway structure. The water diversion capacity is 3,200 cfs, which would require a minimum 8,000 square feet of screen. A conventional V-screen for the water intake would minimize the length of the screen. The V-screen would terminate in an approximately 36-inch fish bypass pipe that would flow over the dam and into the downstream river area. As with the V-screen for the J.C. Boyle Development, the V-screen would be fabricated off-site and installation would require dewatering and isolation to provide a dry or partially isolated work area.

Tailrace Barrier

The power generation turbines for Copco 2 are several miles downstream from the dam with a large tailrace area that flows back into the Klamath River. The water flowing out through this tailrace has the potential to attract fish to a false pathway. Prescriptions require a tailrace barrier unless studies prove otherwise (DOI and NOAA Fisheries Service 2007); Alternative 4 includes a tailrace barrier because the orientation and nature of the tailrace area indicate that a barrier would likely be necessary. The Fish Passage at Four Dams Alternative includes extending the bank line of the Klamath River and installing a cutoff screen to prevent fish from straying into the tailrace area (see Figure 2-27).

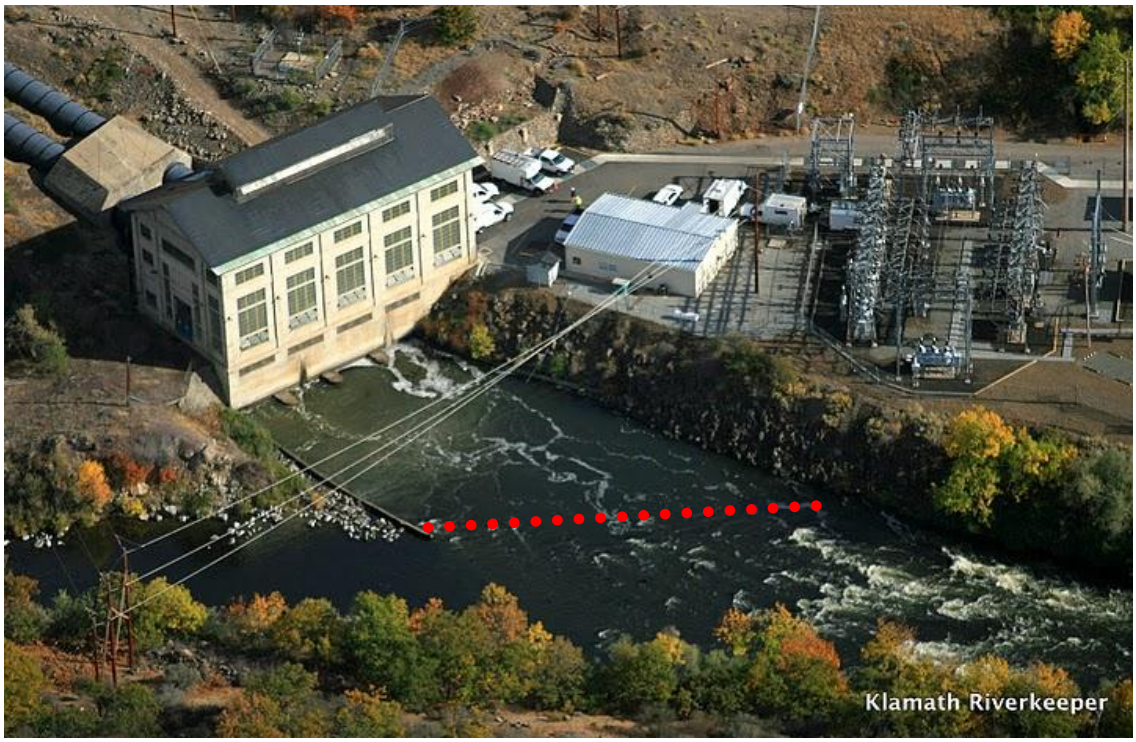


Figure 2-27. Modifications at the tailrace of the Copco 2 Powerplant would extend the bank and install a tailrace barrier screen (red dots)
(Source: Klamath Riverkeeper)

Iron Gate Dam Fish Passage Facilities

The Iron Gate Development has difficult site access because of steep canyon terrain. It would require construction of temporary roads for site access and a tower crane or aerial tramway to move construction materials.

Upstream Fish Passage

The Fish Passage at Four Dams Alternative would include installation of a fish ladder on the left side of Iron Gate Dam near the existing penstock pipe, as shown in Figure 2-28. The fish ladder would have two entrances with entrance pools at the downstream end of the fish ladder. An AWS would feed water into the fish ladder at two locations to help with attraction flows and water temperatures. Multiple openings would be necessary where the fish ladder connects to the reservoir to allow for water level fluctuation. Construction would require installation of the cast-in place concrete ladder and isolation of the area where the ladder connects to the reservoir.

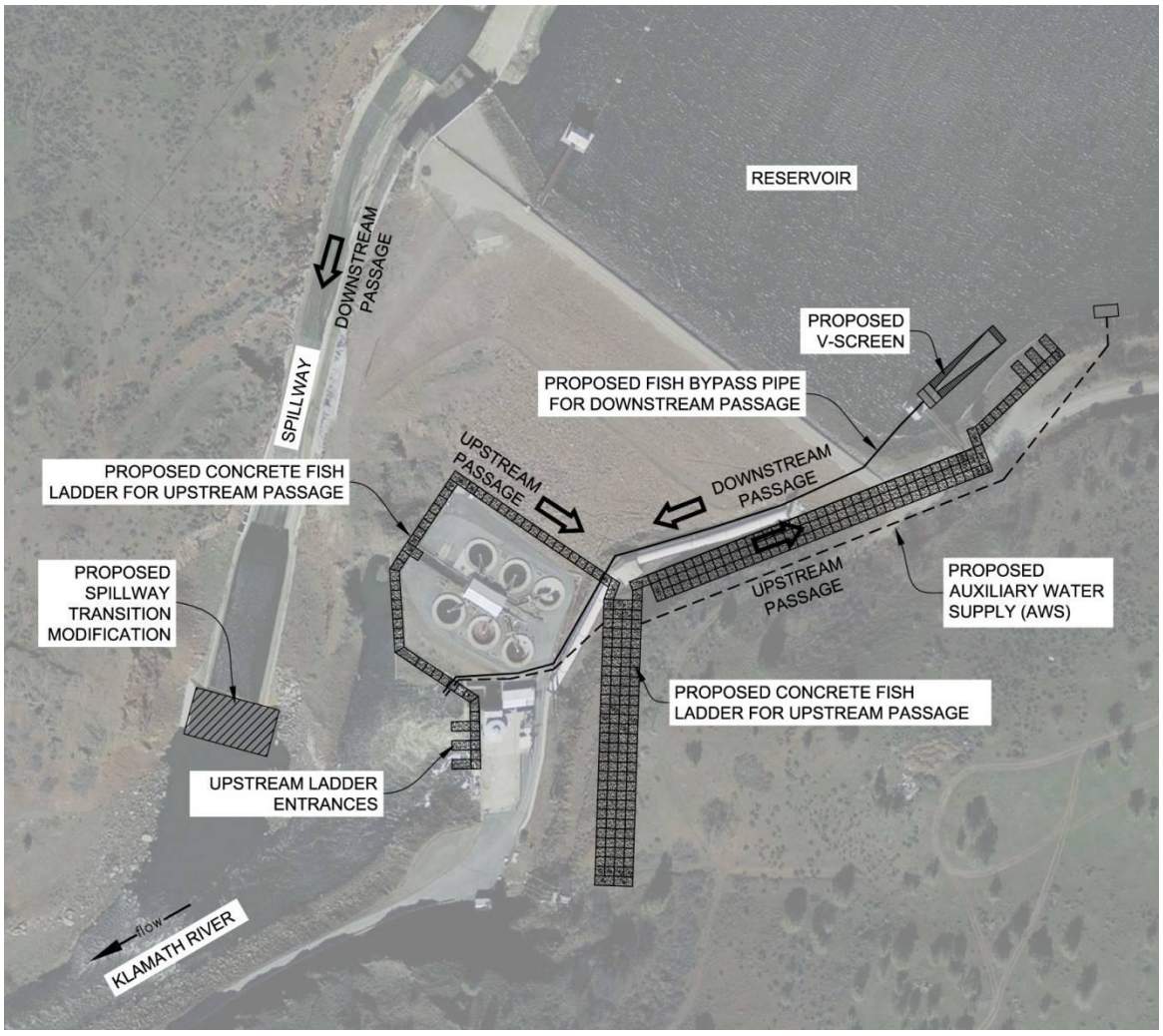


Figure 2-28. Conceptual fish passage facilities layout for Iron Gate Dam showing fish ladder, water intake screen, and spillway transition modifications

Downstream Fish Passage – Water Intake

The existing power generation water intake structure at Iron Gate Dam is on the left side of the embankment dam. The water intake design flow is 1,735 cfs and would require a minimum fish screen of 4,340 square feet based on an approach velocity of 0.4 ft/s. A conventional V-screen would be the best option for screening the water intake to address the substantial size of the screen. The V-screen would terminate in a 36 inch diameter fish bypass pipe (approximately 40 cfs) that would run from the water intake to a fish bypass facility for identification of downstream migrating juveniles and then continue downstream to the river below the dam. The V-screen would be stainless steel and the fish return pipe would be standard steel with concrete and steel support structures along the length of the pipe. As with the V-screen for the J.C. Boyle facility, the V-screen would be fabricated off-site and installation would require dewatering and isolation to provide a dry or partially isolated work area.

Downstream Fish Passage – Spillway

The Iron Gate spillway is an unregulated, free overflow from the reservoir area. Likely modifications to the spillway would include building a smoother transition at the downstream end using cast-in-place concrete to form an ogee-type drop structure that would connect the downstream river levels to the free flowing spill conditions. This modification would reduce fish mortality on the rock outcrop below the spillway. In addition, the Hydropower Licensee would use concrete to fill the area just upstream of the free outfall at the downstream end of the spillway to make a consistent hydraulic transition and reduce potential harm during downstream passage of primarily juvenile fish.

2.4.5.2 Schedule

The schedule would likely follow the schedule prescribed in the FERC relicensing process. The prescriptions include a schedule for implementation and recommend that downstream facilities be installed prior to upstream passage facilities (DOI and NOAA Fisheries 2007). Table 2-26 shows the schedule for construction of the fish passage facilities at each dam, based on these constraints.

Table 2-26. Timetable for Fish Passage Improvements at each Dam from Date of FERC License Renewal

Dam	Upstream Fish Passage	Spillway Modifications	Tailrace Barrier	Screens & Bypass
J.C. Boyle	4 years	4 years	4 years	4 years
Copco 1	6 years	6 years	N/A	6 years
Copco 2	6 years	6 years	8 years	6 years
Iron Gate	5 years	5 years	N/A	5 years

Key:
N/A: Not Applicable

2.4.5.3 Workforce

Table 2-27 shows the estimated workforce necessary for construction at each facility. Each facility would also have 5 to 10 on-site construction administrative personnel (e.g., inspectors, field engineers) for the duration of the project.

Table 2-27. Estimated Average Construction Workforce for Fish Passage at Four Dams

Facility	Estimated Construction Workforce	Duration
J.C. Boyle	10 to 20 people	4-6 months
Copco 1	15 to 25 people	9 months
Copco 2	10 to 20 people	4-6 months
Iron Gate	15 to 30 people	12 months

2.4.5.4 Environmental Measures

The Fish Passage at Four Dams Alternative would incorporate standard measures to reduce environmental effects. These measures would be the same as those included in the Proposed Action (see Section 2.4.3).

2.4.5.5 Trap and Haul around Keno Impoundment – Programmatic Measure

NOAA Fisheries Service prescriptions include a measure to trap and haul fall-run Chinook salmon upstream and downstream around Keno Impoundment. The prescriptions call for seasonal trap and haul operations from June 15 to November 15 when water quality conditions are not suitable for fish (dissolved oxygen concentration less than 20 mg/l or temperature above 20 degrees Celsius) (DOI and NOAA Fisheries Service 2007). Upstream operations would include construction of a collection and handling facility downstream of Keno Dam; these fish would be released upstream of Link River Dam. Downstream operations would include construction of a collection and handling facility at Link River Dam that would also collect fish from the East Side and West Side canals. These fish would be released downstream from Keno Dam. The exact details of the collection facilities, haul routes, or necessary road improvements are not yet defined; therefore, this measure is analyzed in this EIS/EIR at a programmatic level.

2.4.6 Alternative 5: Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate

The Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative consists of the full removal of Iron Gate and Copco 1 facilities and installation of upstream and downstream fish passage facilities at both the J.C. Boyle and Copco 2 Dams. On Copco 2 and J.C. Boyle Dams, ladders would be less complex to construct and provide volitional fish passage because of dam height and reservoir length. Iron Gate and Copco 1 Dams also provide less power; therefore, removal would have less effect on power generation. Removing Iron Gate and Copco 1 Reservoirs, the two largest impoundments in the Hydroelectric Reach, would also address water quality problems driven by reservoir size, such as increased water temperature, low dissolved oxygen, and toxic algal blooms in the summer and fall.

In order to meet current criteria for volitional fish passage, J.C. Boyle and Copco 2 Dams would require new upstream and downstream fish passage facilities. The fish passage facilities at J.C. Boyle and Copco 2 Dams would be the same as in the Fish Passage at Four Dams Alternative; Section 2.4.1 describes these facilities in detail. Similar to the Fish Passage at Four Dams Alternative, the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would incorporate most of the prescriptions from the FERC relicensing process related to fish passage at J.C. Boyle and Copco 2 Dams (see Attachment B of Appendix A for a list of prescriptions). Alternative 5 would not incorporate the prescriptions related to peaking power at J.C. Boyle and recreation releases. In Alternative 5, Copco 2 Dam would be the only dam remaining downstream from J.C. Boyle Dam. Copco 2 Reservoir is very small, and does not have adequate capacity to reregulate flows associated with peaking operations so that they are suitable for fish downstream. Therefore, Alternative 5 would not include peaking operations or recreation releases on any days at J.C. Boyle Dam.

Alternative 5 flows would be driven by releases from J.C. Boyle Dam because of the lack of downstream reregulation. The prescriptions would require 40 percent of J.C. Boyle releases to enter the Bypass Reach; therefore, these flows would be greater than the No Action/No Project Alternative. Flows at the Iron Gate Gauge would be generally similar to the No Action/No Project Alternative to maintain suitable flows for fish, although they may experience small variations because Iron Gate and Copco 1 Dams would not be in place to control flow patterns.

Removal of Iron Gate and Copco 1 Dams would be the same as in the Proposed Action; Section 2.4.3 describes the removal plans in more detail. Inflows to Upper Klamath Lake, and outflows from Copco 2 Dam and fish ladder and the Copco 2 Powerhouse are assumed to be nearly the same under the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative as described above for the No Action/No Project Alternative.

A Hydropower Licensee would implement this alternative and would be responsible for its long term operation and maintenance. The Hydropower Licensee would need to re-enter the FERC process to implement this alternative. Implementation of the KBRA is not included in the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative. The Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would not satisfy the KHSA; consequently, the KBRA would not be implemented (although ongoing restoration activities in the No Action/No Project Alternative may continue). For the purposes of this analysis, alternatives that would not result in full implementation of the KHSA do not include the KBRA as a connected action to the alternative. Additionally, the transfer Keno Dam to DOI would not move forward as a connected action.

2.4.6.1 Schedule

This alternative would follow a schedule similar to that of the Proposed Action, because two of the dams are being removed and fish passage would be necessary as soon as possible after dam removal. Similar to Alternative 4, downstream fishways at each site would be completed before upstream fishways. Figure 2-29 shows the schedule for construction of the fish passage facilities at two dams and for removal of the remaining two dams, based on these constraints.

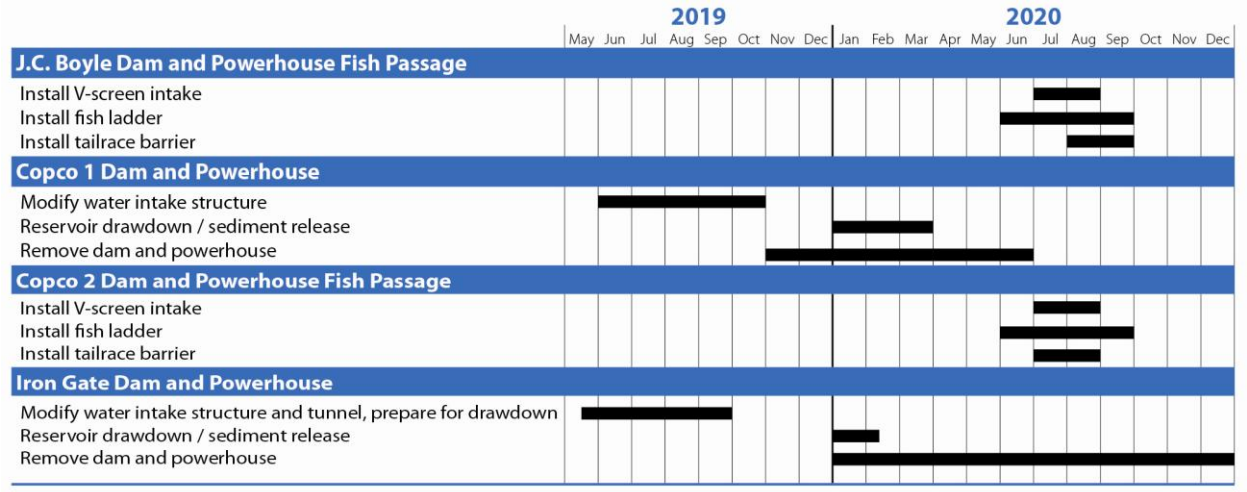


Figure 2-29. Anticipated schedule for Fish Passage at J.C. Boyle and Copco 2 Dams with Removal of Copco 1 and Iron Gate Dams

2.4.6.2 Workforce

Table 2-28 shows the estimated workforce necessary for each facility under this alternative. In addition to the average construction workforce, there would be 5 to 10 on-site construction management staff (e.g., inspectors, field engineers) at each site for the duration of the project. The deconstruction efforts at Copco 1 and Iron Gate Dams would constitute the bulk of the efforts in this alternative.

Table 2-28. Estimated Construction Workforce for Full Removal of Iron Gate and Copco 1 Dams with Fish Passage at Copco 2 and J.C. Boyle Dams

Facility	Estimated Average Construction Workforce	Duration	Estimated Peak Workforce	Peak Period
J.C. Boyle	10 to 15 people	4 to 6 months	15–20	Jul 2020–Sep 2020
Copco 1	30 to 35 people	12 months	50–55	Nov 2019–Apr 2020
Copco 2	10 to 15 people	4 to 6 months	15–20	Jul 2020–Sep 2020
Iron Gate	35 to 40 people	18 months	75–80	Jun 2020–Sep 2020

2.4.6.3 Environmental Measures

The Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would incorporate standard measures to reduce environmental effects. These measures would be the same as those included in the Proposed Action (see Section 2.4.3).

2.4.6.4 Recreation Facilities

Recreation facilities near J.C. Boyle Reservoir would stay intact, and the Copco 2 area does not have any developed recreation facilities. Recreation facilities at Iron Gate and Copco 1 (see Table 2-29) would be removed.

Table 2-29. Recreation Facility Changes under the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative

Site Name	Existing Facilities	Facilities Following Dam Removal
Sites at Copco 1 Reservoir (California)		
Mallard Cove	Day-use picnic area and boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Copco Cove	Picnic area and boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Sites at Iron Gate Reservoir (California)		
Fall Creek Trail	Day-use area and trail	This site would remain, there would be no improvements or changes
Jenny Creek	Day-use area and campground	This site would remain, there would be no improvements or changes
Wanaka Springs	Day-use area, campground, boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Camp Creek	Day-use area, campground, boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Juniper Point	Primitive campground and boat dock	All facilities would be removed. Parking area would be regraded, seeded, and planted
Mirror Cove	Campground and boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Overlook Point	Day-use area	All facilities would be removed. Parking area would be regraded, seeded, and planted
Long Gulch	Picnic area and boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Dutch Creek	Day-use area	All facilities would be removed. Parking area would be regraded, seeded, and planted
Iron Gate Fish Hatchery Public Use Area	Day-use area and boat launch	This site would remain, there would be no improvements or changes

Source: O'Meara 2010

2.4.6.5 Trap and Haul around Keno Impoundment – Programmatic Measure

The Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would include trap and haul measures to move fish around Keno Impoundment when water quality is not suitable for fish. The measures would be the same as those described in the Fish Passage at Four Dams Alternative (see Section 2.4.5). The exact details of the collection facilities, haul routes, or necessary road improvements are not yet defined; therefore, this measure is analyzed in this EIS/EIR at a programmatic level.

2.5 Preferred Alternative

The DOI has not identified a Preferred Alternative. After receiving public comment on this Draft EIS/EIR and further consultation with cooperating agencies and other stakeholders, the DOI will either adopt one of the existing alternatives (potentially modified) or a new alternative as its Preferred Alternative. The Preferred Alternative or new alternative may be a combination of existing alternatives or an alternative within the spectrum of alternatives already analyzed.

2.6 References

BLM. 2011. Klamath River Gravel Placement and Bypass Barrier Removal Environmental Assessment. Available from: http://www.blm.gov/or/districts/lakeview/plans/index.php?display=Lakeview. Accessed on September 13, 2011.

CH2M Hill. 2003. Fish Passage Facilities Technical Memorandum 6-9. Prepared for Fish Engineering Subgroup by Bob Gatton. February 26.

Department of the Interior (DOI) and National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries Service). 2007. United States Department of the Interior and National Marine Fisheries Service Modified Prescriptions for Fishways and Alternatives Analysis Pursuant to Section 18 and Section 33 of the Federal Power Act for the Klamath Hydroelectric Project (FERC Project No. 2082). January 26, 2007.

DOI. 2011. Technical Report No. SRH-2011-02 Hydrology, Hydraulics and Sediment Transport Studies for the Secretary's Determination on Klamath River Dam Removal and Basin Restoration Klamath River, Oregon and California.

Federal Energy Regulatory Commission. 2007. Final Environmental Impact Statement for Hydropower License, Klamath Hydroelectric Project, FERC Project No. 2082-027, FERC/EIS-0201F. Washington, DC, Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing.

Klamath Riverkeeper: Photo of Copco 1 Powerhouse, taken October 22, 2009. Accessed 2/28/2011. Available at: http://lh5.ggpht.com/_Vmqtjopo_5s/SvEJz1sgbyI/AAAAAAAABtM/LCNFl1bbY8g/s720/SHP_8722.JPG

NOAA Fisheries Service. 2008. Southwest Regional Office – Protected Resource Division. Accessed web page http://swr.nmfs.noaa.gov/deter/index.htm (10/18/10).

NOAA Fisheries Service. 2010. Biological Opinion, U.S. Bureau of Reclamation, Operation of the Klamath Project between 2010 and 2018. National Marine Fisheries Service, Southwest Region. March 15, 2010.

NOAA Fisheries Service. 2011. Federal Register Notice of Availability regarding Incidental Take Permit and Habitat Conservation Plan for PacifiCorp Klamath Hydroelectric Project Interim Operations. Available at: http://www.federalregister.gov/articles/2011/05/04/2011-10902/incidental-take-permit-and-habitat-conservation-plan-for-pacificorp-klamath-hydroelectric-project. Accessed on July 13, 2011.

North Coast Regional Water Quality Control Board (NCRWCB). 2010a. Final Staff Report for the Klamath River Total Maximum Daily Loads (TMDLs) Addressing Temperature, Dissolved Oxygen, Nutrient and Microcystin Impairments in California, the Proposed Site Specific Dissolved Oxygen Objectives for the Klamath River in California, and the Klamath River and Lost River Implementation Plans.

NCRWCB. 2010b. Action plan for the Klamath River total maximum daily loads addressing temperature, dissolved oxygen, nutrient, and microcystin impairments in the Klamath River in California and Lost River implementation plan. Santa Rosa, California. http://www.swrcb.ca.gov/northcoast/water_issues/programs/tmdls/klamath_river/.

O'Meara, S. B. Greimann, and J. Godaire. 2010. Reservoir Area Management Plan for the Secretary's Determination on Klamath River Dam Removal and Basin Restoration. 31 December.

Oregon Department of Environmental Quality. 2010. Upper Klamath and Lost Rivers TMDL and WQMP. Available at: http://www.deq.state.or.us/wq/tmdls/klamath.htm#upks. Accessed on March 24, 2011.

Philip Williams & Associates. 2009. A River Once More: The Klamath River Following Removal of the Iron Gate, Copco and J.C. Boyle Dams. Prepared for the California State Coastal Conservancy.

Ratliff, D. et al. 1999. Alternatives for Renewing Fish Passage at the Pelton Round Butte Hydroelectric Project. Prepared for Portland General Electric. 133 p.

United States Fish and Wildlife Service. 2008. Formal Consultation on the Bureau of Reclamation's Proposed Klamath Project Operations from 2008 to 2018. April 2, 2008.

United States Geological Survey. 2011. USGS Real Time Water Data for USGS 11510700 Klamath River Below John C. Boyle Powerplant, Near Keno, OR. Available from: http://waterdata.usgs.gov/or/nwis/rt. Accessed on July 18, 2011.